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CIGARETTES

of IMPORTED and DOMESTIC tobaccos — Blended



**"Satisfy?" Yes
Yet they're Mild**

Yes, Chesterfields "reach home," they let you know you are smoking — they "Satisfy"! Yet, they're Mild.

A new blend of pure, Imported and Domestic tobaccos — that's the answer. And the blend can't be copied.

Make Chesterfields your next buy.

Liggett & Myers Tobacco Co.

10c a package



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Sons and Fathers Meet at Billiards —MAN TO MAN!

Play Carom and Pocket Billiards in your home and rear red-blooded boys. Unite *all* members of your family in this life-long comradeship. Homes need the protection of these fascinating pastimes shared in common—you owe your boys and girls your own society.

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BRUNSWICK

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Not toys—but scientific Carom and Pocket Billiard Tables with fast Monarch cushions, accurate angles and ever-level playing beds.

Handsome designs in oak and mahogany. Regular or folding styles in sizes to fit all homes.

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DEALERS: Write for agency proposition without delay.

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You may send me free copy of your color book—"BILLIARDS—The Home Magnet," and tell about your home trial offer.

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ACCEPT NO "CYPRESS" UNLESS IT BEARS THIS MARK:—

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MANUFACTURED BY
ASSOCIATION MILLS
IS IDENTIFIED BY
THIS TRADE-MARK**



TRADE MARK REG. U.S. PAT. OFFICE

Only mills which are qualified by the superior physical character of their product AND the ethical character of their business practice can belong to the Southern Cypress Mfrs. Assn.—and *only member-mills* can ever apply this legally registered trade-mark to ANY Cypress.

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"Tide-water" Cypress

YOU CAN TELL IT BY THE ARROW

(shown above) Indelibly
Stamped in the end of EVERY
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Our entire resources are at your service with Reliable Counsel.

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IF HE HASN'T IT, LET US KNOW.

TELL HIM TO REMEMBER "BUY BY THE CYPRESS ARROW"

"Signed Lumber is Safe Lumber."

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CONTENTS FOR OCTOBER—Continued

PICTURE PAGES	Page		Page
Army Refrigerating Devices	486	A Simple Toy Motor Run with Dry Sand	638
Trained Horses for the New York Mounted Police	487	Wigwam Made of a Tripod	639
Making Anti-Submarine Nets	488-9	A Siphon Made of Gas Pipe and Fittings	640
What It Means to Feed and Clothe the Armies of the Allies	490-491	Making a Miter Box for Cutting Trestle Legs	640
The Sahara Viewed from an Airplane	492	Replacing Tongue in a Fancy Brass Hook	640
Specimens of Indian Art	493		
Food—Food Everywhere and Not a Bit to Eat	494		
French Forces Using Liquid Fire	495		
Dolling Up Your Ford	496-497		
Big Guns Used by the Coast Artillery	498-499		
Various Stages in the Development of a Waap	500-502		
PHOTOGRAPHY AND MOTION-PICTURES		RADIO COMMUNICATION	
The Original Motion Picture Film	484	A Simple and Attractive Loading Coil	601
Taking Pictures a Thousand Feet Under Water	577	Transmitting Wireless Messages Underground Without Aerial	602
Moving Pictures That Really Talk	578	Sending Wireless Messages Under Fire	603
Aim and Pull the Trigger to Photograph an Enemy from the Air	585	Construction of a Rotating Arm for a Rotary Gap	606
Making It Easy to See the "Movies"	599	Wireless Work in Wartime	607
		A Grid Placed in the Wings of an Airplane	614
PRACTICAL WORKERS' DEPARTMENT		RAILWAYS	
Using a Bicycle Pump for a Water Rheostat	601	How Print Butter Is Shipped to the Retailer	519
A Flexible Spline Used for a Draughtsman Curve	602	Safeguarding Our Bridge and Railroad Crossings	565
New Type of Acid Proof Brush for Soldering Flux	606	Putting Driving Wheels Under the Locomotive Tender	570
The Underwriter's Knot for Flexible Cords	610	A Lift Deck for Automobile Freight Cars	592
Testing for Trouble That Causes Poor Automobile Lights	610	A Lumberman's Camp Which Can Be Moved from Place to Place on Rails	598
Making a Practical Vacuum Cleaner	611	Canning the Baby in a Super Sleeper	513
Blackboard an Adjunct to the Amateur's Shop	614	Flagman's Shelter House Built Like a Mosque	551
An Interesting Thermo-Magnetic Motor	614		
An Undercoating for Copper to Hold Paint	614		
Stropping a Razor on the Fleahy Part of the Hand	615		
Warming Army Tent with Improved Stoves	615		
Making a Camphre Tent with an Awning	616		
Preserving Flowers in Natural Colors with Wax	616		
How to Reline Your Automobile Brakes	617		
Cord Cutter Made from a Safety Razor Blade	618		
Temporary Repair on a Broken Lubricator Filling Glass	618		
Sheet Metal Working Simply Explained	619		
Ingredients That Make the Best Kind of Glue	620		
An Inexpensive Cesspool Made of a Barrel and Cask	620		
Pedal-Operated Brake for a Belt Driven Motorcycle	621		
Making a Soldering Iron Heater of Pipe and Fittings	621		
A Durable Paint for Surfaces Exposed to the Weather	621		
Clip for Carrying Pipe in the Vest Pocket	622		
A Silvering Process for Glass Instruments and Mirrors	622		
Holding the T-Square on the Drawing-Board	622		
Range Finder to Locate Landmarks and Signal Fires	623		
A Convenient Pivoted Card File for the Desk	624		
Three Methods for Finding a Chosen Card	625		
Piping Automobile Engine Exhaust Gas from Garage	626		
Edging Flower Beds with Bottles	626		
Repairing a Broken Test Tube or Beaker	626		
Making and Using a Casting Rod	627		
Making a Cabin Tent Out of Ordinary Shooting	629		
Holding Papers on a Movable Sloping Desk-Top	630		
Keeping Oil from V-Belt of a Motorcycle	630		
Building a Model Airplane Kite	631		
Repairing a Broken Link in a Motorcycle Roller Chain	632		
Grouping Sheet Music into Books and Binding Them	632		
A Teeter Swing for Public or Private Playground	633		
An Experiment with Sulphate of Soda	633		
Cutting Brass Tubing Rapidly on a Butz Saw	634		
A Wood Lift Built in Like a Dumb-Waiter	634		
Improving Piano Tone by Making Air Humid	635		
Simple Camera Attachment for Photographic Enlarging	635		
Bracing for an Iron Pipe Fence Post	636		
Attaching Linoleum to a Cement Floor	636		
Casing for Carrying Tube Cements Without Damage	636		
A Silver Plating Bath and How to Use It	636		
		SHIPS AND SHIP BUILDING	
		The Graveyard of Ships That Passed in the Night	520
		The Life-Preserver Is More Important Than Meals Aboard Ship	521
		Boats That Travel on Land and Water	523
		She Launches Scaplanes and She's Unsinkable	529
		A Houseboat of Marble	538
		Even a Battleship Would Sink If It Were Not Cleaned	554
		Shall We Build Concrete Ships?	556
		She Was Torpedoed but Her Cargo Plugged the Hole	569
		Signaling Storms to Mariners	582
		SPORTS AND PASTIMES	
		Pulling and Pushing to Make the Swing Go	524
		Lowering the Life-Boats by Means of Gear-Operated Davits	533
		Put These Webbed Gloves on and Swim Like a Duck	533
		Maltreating a Water Bottle to Test Its Strength	536
		Making a Mule Push and Pull at the Same Time	586
		A Water-Cooling and Purifying Pipe for the Fastidious Smoker	590
		MISCELLANY	
		The Umbrella Hat	184
		From Soup to Nuts	514
		Work the Typewriter Standing or Sitting	516
		Each Salesman Has His Own Telephone in This Grocery	516
		A Pencil-Pen Without Wood, Rubber or Graphite	520
		Two Dies in One	522
		It Holds and Presses Your Tie at the Same Time	522
		In Japan the Barber Cleans His Patron's Ears	524
		It Takes About 150 Pounds Pressure to Break an Egg	525
		What Makes a Man a Criminal	526
		Let Cheese Be Your Meat Substitute	533
		How You Light Your Cigar in Italy	537
		The More You Pay for Your Clothes, the More They Suffer on the Clothes Line	569
		And These Are Not Leather?	571
		Where Violin and Tennis Strings Come From	581
		A Convenient Device for Keeping Your Razor Blades Clean	584
		A New Zinc Product Which Is a Substitute for Tin-foil	585
		To Keep Out Burglars Leave Your Key in the Door	591
		The Over-All Hat Entered the Fashion Sheets	591
		Is This the Secret of Curious Finger Prints?	594
		The Ivory Pie-Crust Trimmers of New England	595
		Pack Your Water-Proof in Your Bag	596

POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States \$1.50. Canada, \$2.00. Foreign \$2.50. SINGLE COPY, 15 cents.

POPULAR SCIENCE MONTHLY may be had at all news stands in the United States and Canada; also from the International News Company, Breams Bldg., Chancery Lane, London, E. C., and at Brentano's, 37 Avenue de l'Opéra, Paris.

Forms close the twentieth of the second month preceding date of publication. Advertising rates on application. Entered as second class matter at the New York Post Office, under the Act of Congress of March 3, 1879.

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MODERN PUBLISHING COMPANY, 239 Fourth Avenue, New York City

**WAS
\$100**

The Oliver Typewriter

**A \$2,000,000
GUARANTEE**

**NOW
\$49**

**That This \$49 Typewriter Was \$100
The Sales Policy Alone Is Changed, Not the Machine**

The Oliver Nine—the latest and best model—will be sent direct from the factory to you upon approval. Five days free trial. No money down—no C.O.D. No salesmen to influence you. Be your own salesman and save \$51. Over a year to pay. Mail the coupon now.

On March 1st we announced the Oliver Typewriter Company's revolutionary plans. On that date we discontinued an expensive sales force of 15,000 salesmen and agents. We gave up costly offices in 50 cities.

Prices Cut in Two

By eliminating these terrific and mounting expenses, we reduced the price of the Oliver Nine from the standard level of \$100 to \$49. This means that you save \$51 per machine. This is not philanthropy on our part. While our plan saves you much, it also saves for us.

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The Oliver Typewriter Company gives this guarantee: The Oliver Nine we now sell direct is the exact machine—our latest and best model—which until March 1st was \$100.

This Oliver Nine is a twenty-year development. It is the finest, the costliest, the most successful model that we have ever built.

More than that, it is the best typewriter, in fifty ways, that anybody ever turned out. If any typewriter in the world is worth \$100, it is this Oliver Nine.

Over 600,000 have been sold. This is the same commercial machine used by the U. S. Steel Corporation, the National City Bank of N. Y., Montgomery Ward & Co., Morris & Co., Packers, The Pennsylvania Railroad and a host of others.

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Our new plan is extremely simple. It makes it possible for the consumer to deal direct with the producer.

You may order from this advertisement by using

This Coupon Is Worth \$51

the coupon below. We don't ask a penny down on deposit—no C.O.D.

When the typewriter arrives, put it to every test—use it as you would your own. If you decide to keep it, you have more than a year to pay for it. Our terms are \$3.00 per month. You are under no obligation to keep it. We will even refund transportation charges if you return it.

Or if you wish additional information, mail coupon for our proposition in detail.

**Don't Pay
\$100**

Why now pay the extra tax of \$51 when you may obtain a brand new Oliver Nine—a world favorite—for \$49. Cut out the wasteful methods and order direct from this advertisement.

Or send for our remarkable book entitled, "The High Cost of Typewriters—The Reason and the Remedy." You will not be placed under the slightest obligation.



THE OLIVER TYPEWRITER COMPANY

1107 Oliver Typewriter Bldg., Chicago, Ill.

NOTE CAREFULLY—This coupon will bring you either the Oliver Nine for free trial or further information. Check carefully which you wish.

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TO-DAY**

The Oliver Typewriter Co.,
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No. 1 Contains 346 pages, 358 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 346 pages, 394 illustrations. Motor principles—armature reaction—motor starting—cables—brake horsepower—selection and installation of dynamos and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 428 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lighting systems—recorders—storage battery systems, etc.

No. 4 Contains 270 pages, 370 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 220 pages, 514 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lighting protector apparatus—regulating devices—synchronous condensers—indicating devices—motors—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 310 pages, 370 illustrations. Alternating current, wiring power stations—turbines—managers—selection, location, erection, testing, running, care and repairs—telephones, etc.

No. 8 Contains 332 pages, 456 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 527 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine lighting—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 600 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolyses—electro plating—electro-therapeutics—X-rays, etc.

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You can now develop your brain and body cells to any degree of perfection you desire; you can become a veritable giant in health and mind; you can become superior to any problem that confronts you—and proof against mental or physical fatigue.

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By W. W. Washburn

THE average man has stored in his brain sufficient knowledge to win for him the rich rewards of success if he but uses that knowledge in the right way. The average man has in his body enough potent energy to overcome all illness—if he but uses it in the right way. But the trouble is that only one man in a thousand develops his brain and bodily energy to a point that would make him far superior to other men.

Brain energy is the secret of wealth—cells energy is the secret of health. Yet there is an interlocking dependence which nullifies both, if one is lacking. The man with a powerful physique—without an ache or a pain anywhere—is a ditch digger if he has not developed his brain. The man with a powerful brain cannot put his ideas over if he hasn't cells force and stamina.

Out-Think and Out-Endure Others

Unfortunate is the man with great mental energy but with puny physical fitness. Doubly unfortunate is the man with great physical qualities but with a feeble mentality. Trebly unfortunate is the man with neither: for the world's riches, the best and greatest gifts of humanity come to those

who not only out-think competition among men but to those who can endure competition among humanity.

The truth of the matter is that there is no longer any excuse for anyone who does not possess gigantic power of both mind and body. There has been discovered a new and wonderful system of reconstructing and recreating the human organism—a method that has already revolutionized the lives of men and women all over the country.

Cultivate the Positive Elements

This new system is based on the fact that the brain and body are composed of millions of tiny cells. It has long been known that these cells govern our lives—that we are only as healthy—only as energetic—only as powerful as the cells. When we lack energy and power, when we are listless—when we haven't smashing, driving force back of our thoughts and actions—when we must compel ourselves to meet our daily business and social obligations—when we are sick or ailing—when we cannot think deeply—when we cannot concentrate—when we cannot originate—it is simply because certain cells are weak and inactive or totally dead. Such dormant condition of the cells is found in 90 per cent. of all human beings. Even those who think themselves strong, brainy, energetic, vigorous, highly

vitalized, exuberantly healthy and successful have not attained one-half of what they could attain were they not handicapped by tens of thousands of these inactive or dead cells.

This wonderful discovery of Alois P. Swoboda, of a marvelous, yet simple method of consciously developing these cells to any degree, enables anyone to easily reach any goal of health and wealth desired.

Conscious cultivation of the cells enables you to banish worry, fear, inaction, lack of concentration, lack of will power and all other negative mental characteristics as well as all negative physical characteristics, such as general debility, listlessness, lack of ambition, lack of vitality, weak muscles, languid liver and sluggish stomach, and an almost powerless heart. It enables you to electrify every desirable quality you want, setting it in motion, gathering momentum every day so that no task is too great, no exertion of mind or body tires you. It enables you to cash in on your ideas—it gives you the energy to do things that you would never dream of doing without perfect cell development.

An Amazingly Simple Method

Perhaps the most remarkable thing about this discovery is its astounding simplicity. Only an average of about five minutes a day are required. It does not necessitate the use of drugs, medicines or dieting. It does not include the use of weight exercises or apparatus—there is no massaging or electricity or cold baths or forced deep breathing—in fact, there is nothing for you to do that you do not like to do, and it does not deprive you of any of the pleasures or habits that you get enjoyment out of. Yet so practical is the principle upon which this system is based that you begin to feel refreshed, renewed and re-energized after the first five minutes.



The Swoboda System is as effective for Women as for Men

Only an average of about five minutes a day are required. It does not necessitate the use of drugs, medicines or dieting. It does not include the use of weight exercises or apparatus—there is no massaging or electricity or cold baths or forced deep breathing—in fact, there is nothing for you to do that you do not like to do, and it does not deprive you of any of the pleasures or habits that you get enjoyment out of. Yet so practical is the principle upon which this system is based that you begin to feel refreshed, renewed and re-energized after the first five minutes.

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Swoboda

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Brain and body development as a result of Conscious Evolution is now easy for anyone. Already over 200,000 people have adopted it, and the reports of the physical and financial benefits derived are phenomenal! In the interests of humanity, Mr. Swoboda has written and published for free distribution a remarkable book which explains his system of Conscious Evolution. If you are living an inferior life—if you are not endowed with gigantic power of mind and body—if you are not completely and thoroughly satisfied with your own life both as to health and finance—if you do not think that you are beyond the help of any mortal human being—if you have sufficient ambition to at least learn what the possibilities are for you through Conscious Evolution, write for Mr. Swoboda's book at once—it is free. There is no obligation whatever. Use the coupon below for convenience, but do it at once, so this important matter will not slip your mind. Address, Alois P. Swoboda, 2060 Aeolian Hall, New York City.

ALOIS P. SWOBODA, 2060 Aeolian Bldg., New York City.

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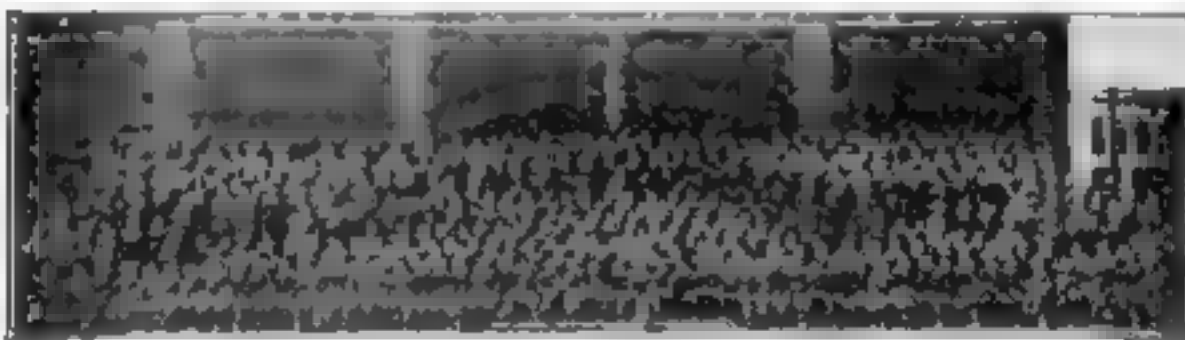
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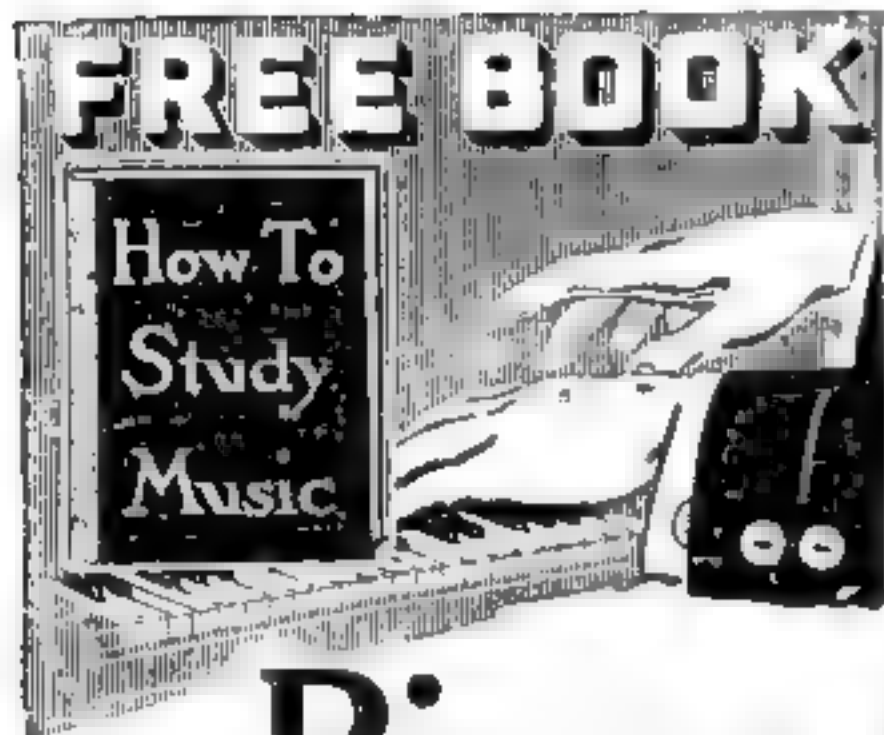
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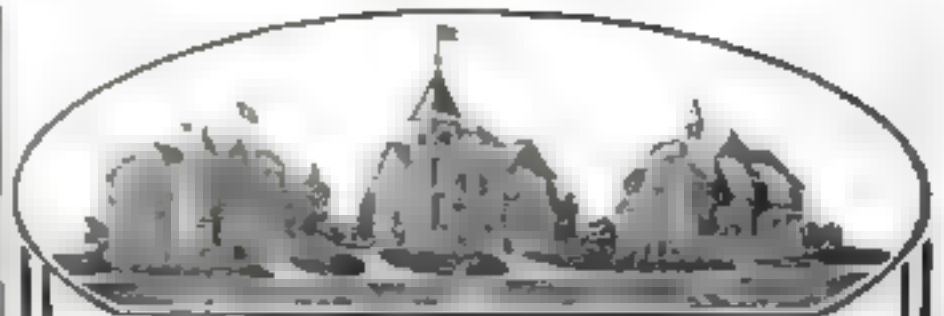
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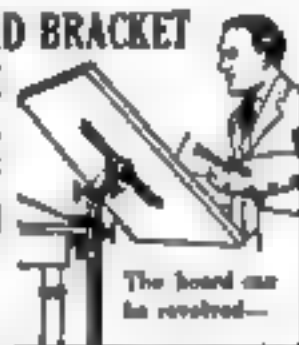
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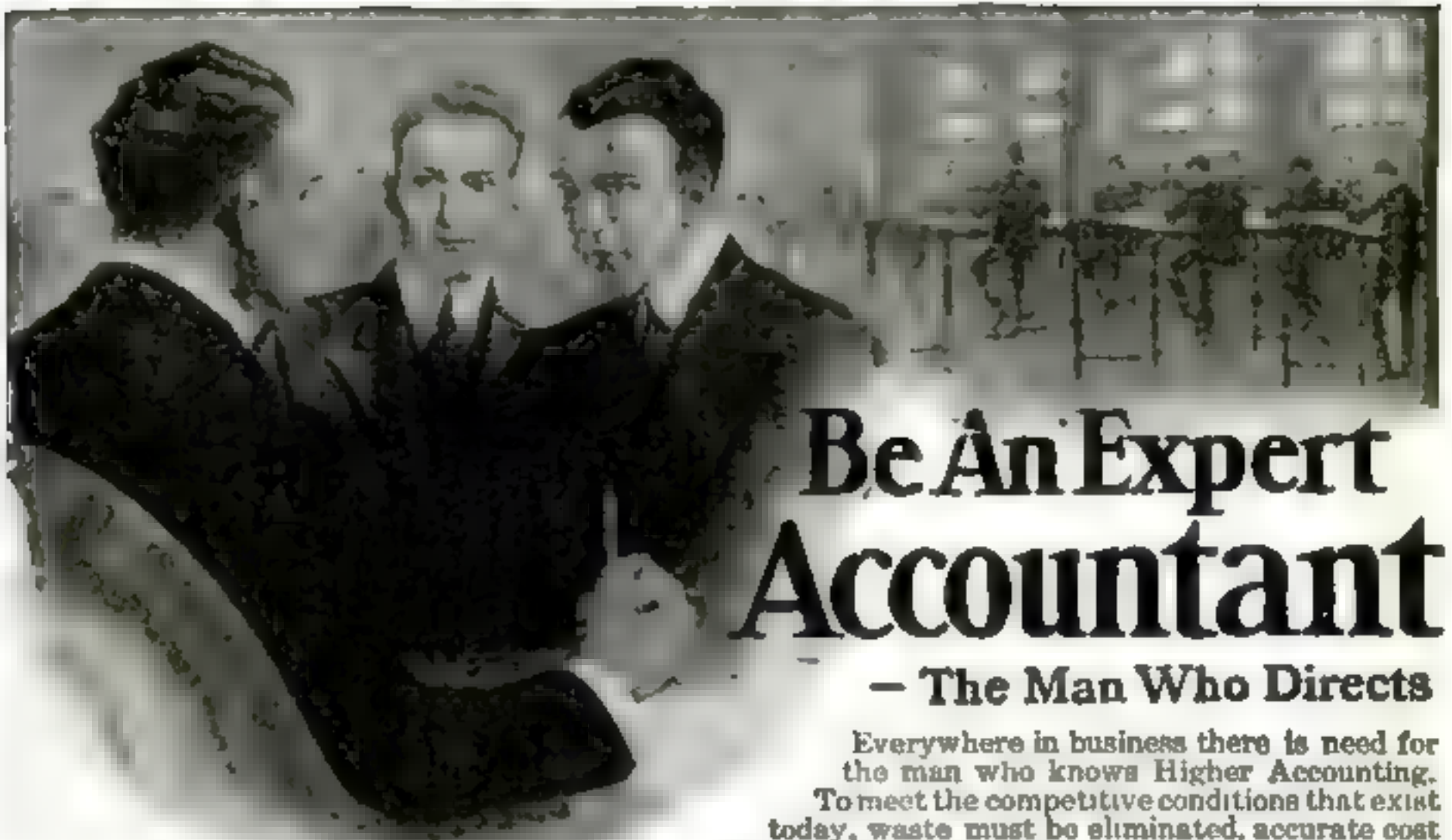


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| <input type="checkbox"/> Telephone Engineer | <input type="checkbox"/> Auditor |
| <input type="checkbox"/> Architect | <input type="checkbox"/> Accountant |
| <input type="checkbox"/> Architectural Draftsman | <input type="checkbox"/> Cert'd Public Acct't |
| <input type="checkbox"/> Building Contractor | <input type="checkbox"/> Stenographer |
| <input type="checkbox"/> Building Superintendent | <input type="checkbox"/> Bookkeeper |
| <input type="checkbox"/> Structural Engineer | <input type="checkbox"/> Fire Ins. Inspector |
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| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Plumber |
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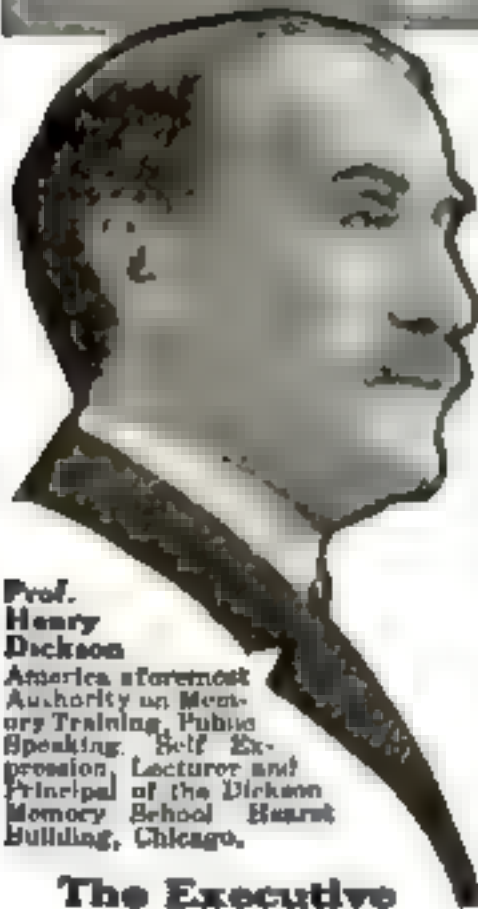
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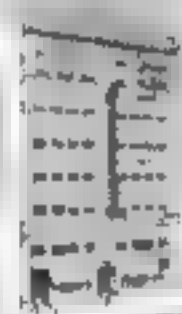
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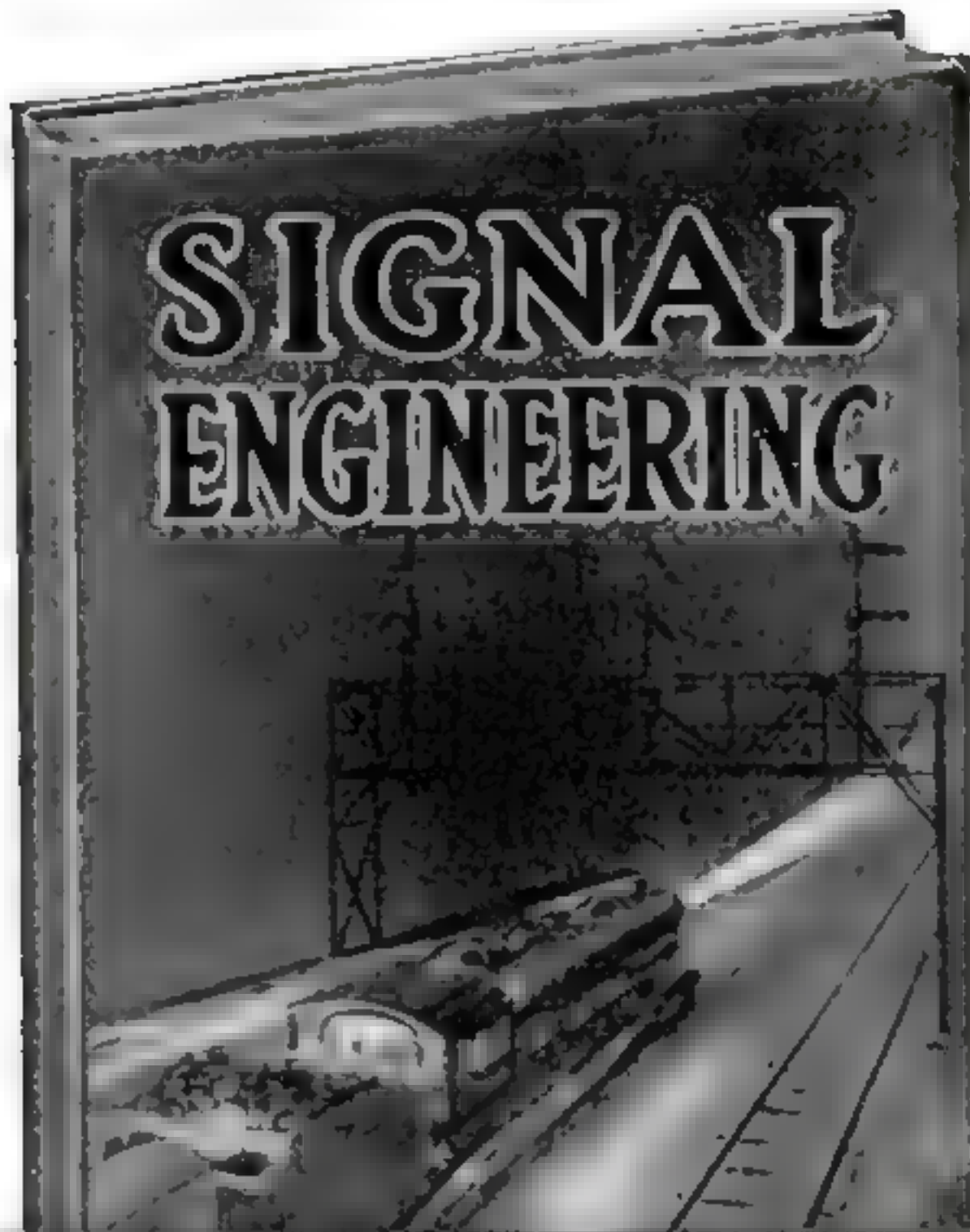
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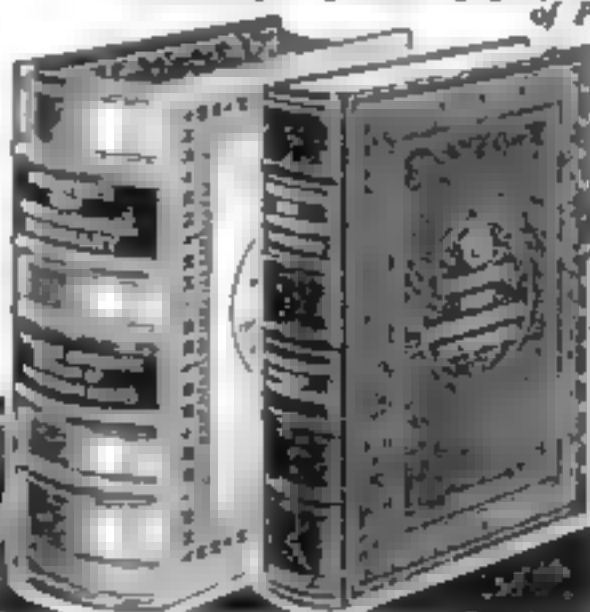
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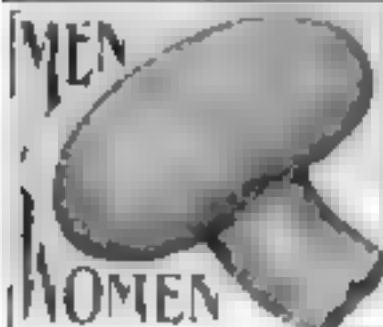


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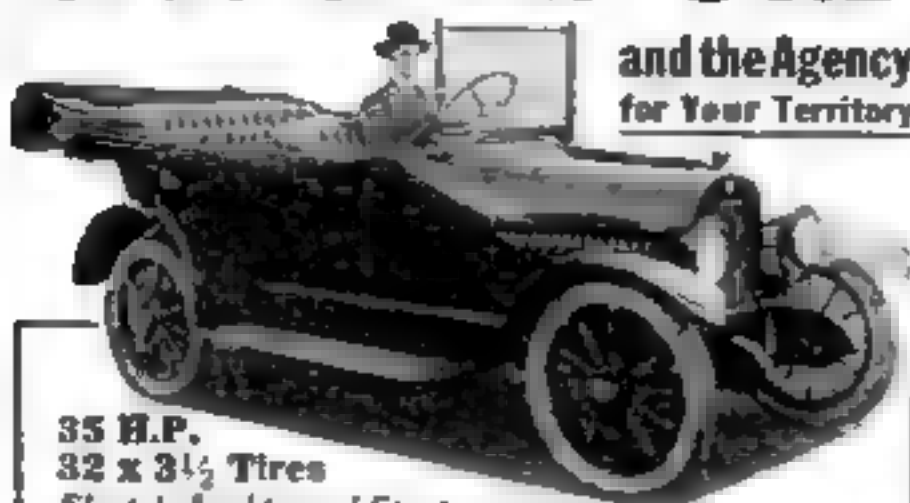
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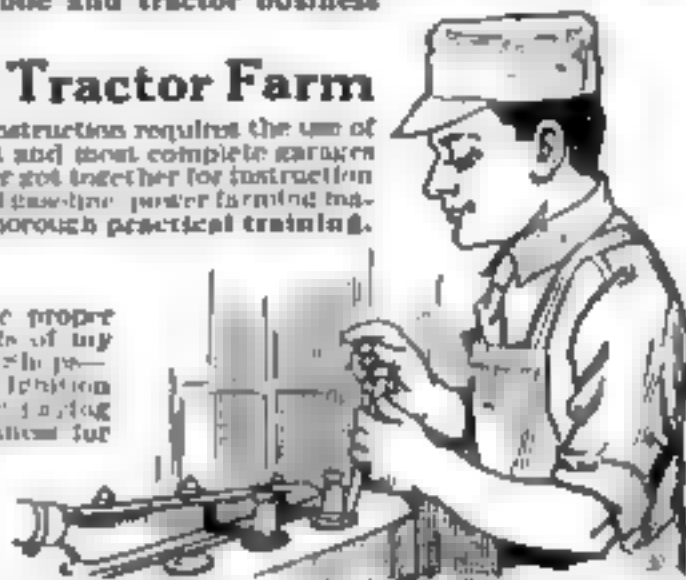
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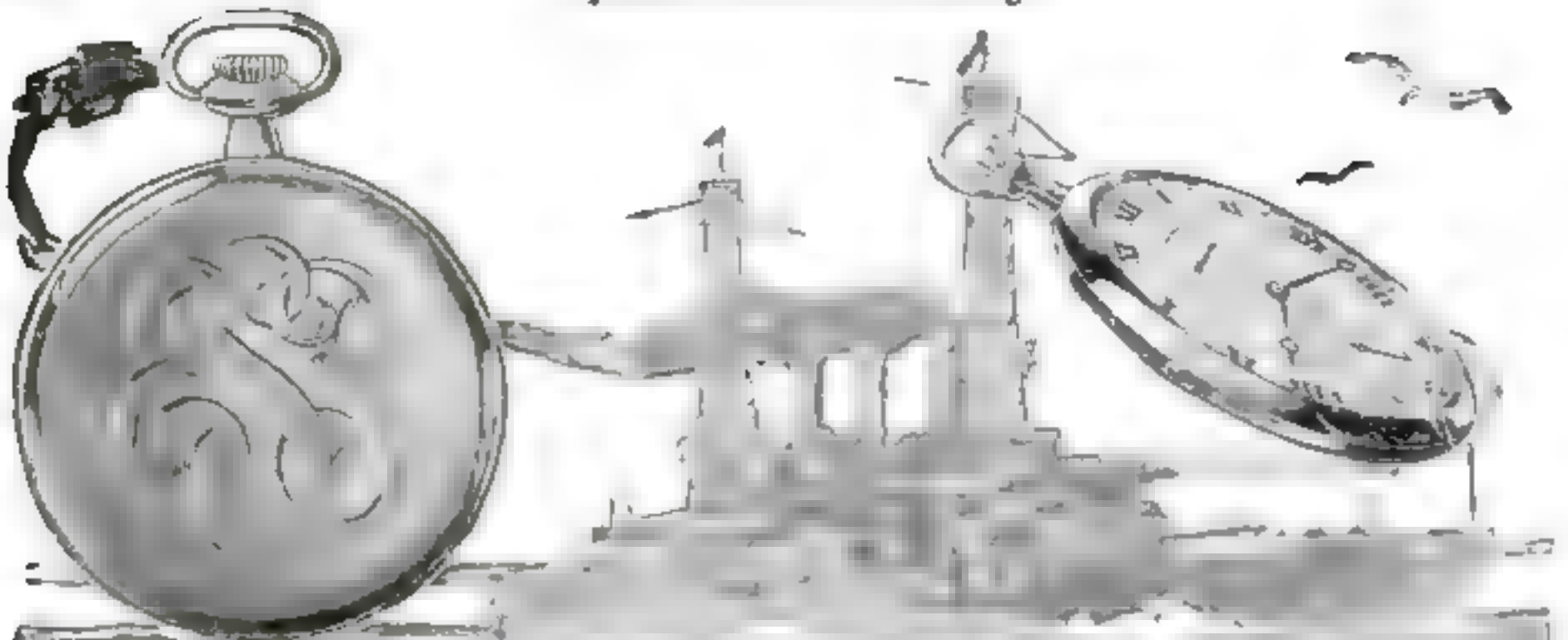
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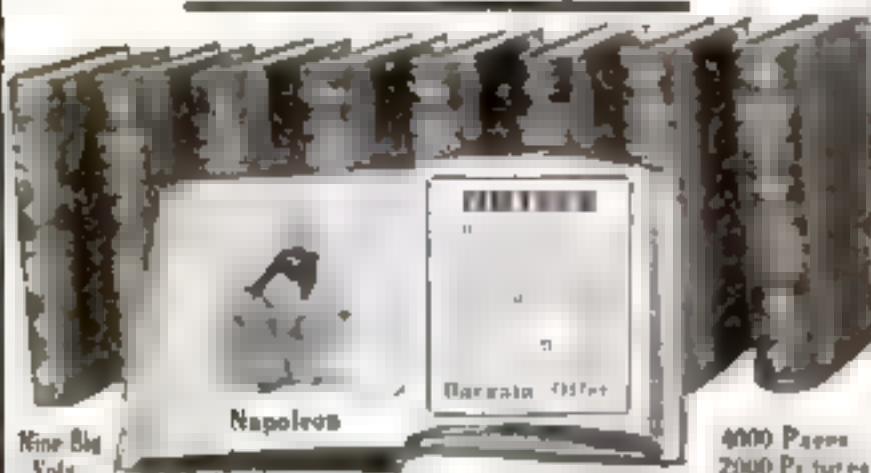
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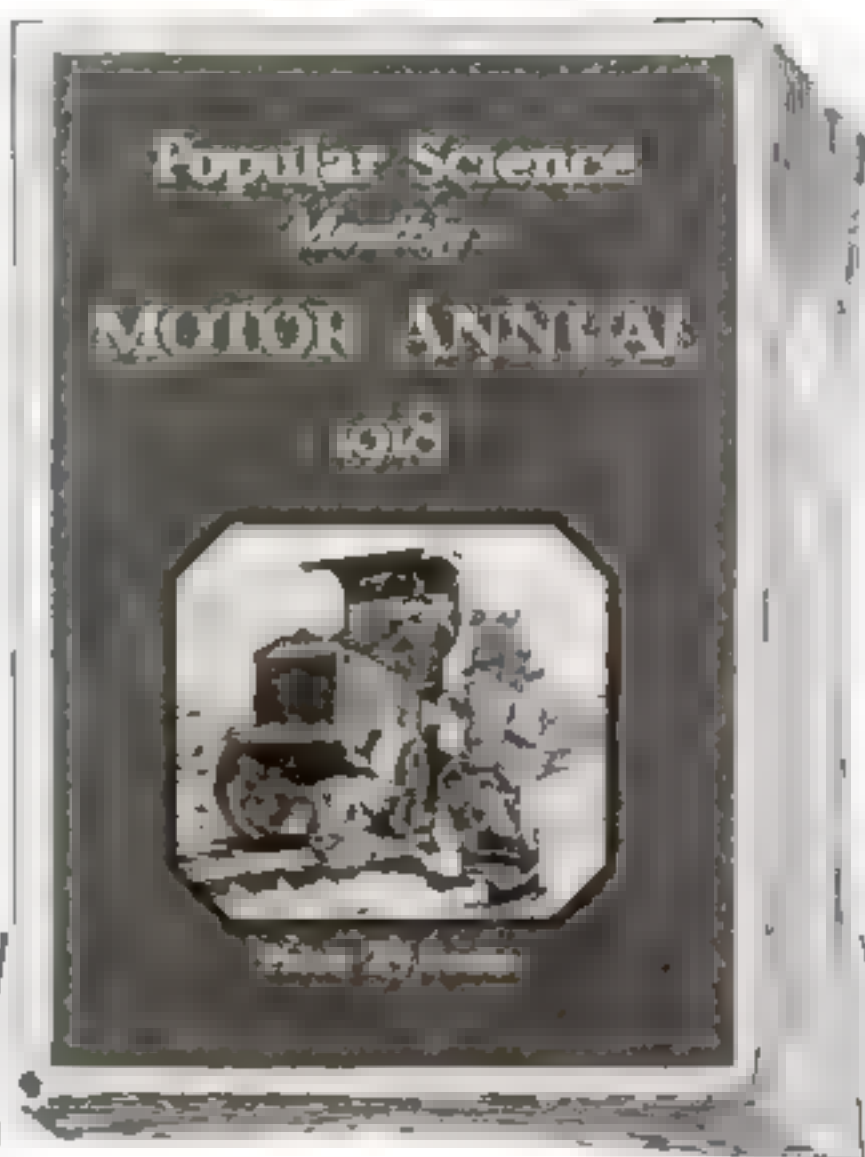
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Start now to master the science of aviation. Help to meet this tremendous demand for trained men. You can learn at home in your leisure time, without giving up your employment—and you do not need a college education. The National Aero Institute offers you a mail course of 58 lessons in the principles of aviation. Your training will be under the supervision of aeronautical experts—men like Walter L. Brock, the famous aviator who won the great London to Paris race. What you cannot, of course, learn to fly by mail, this great home course gives you all the ground work which is necessary to successful flying and all the basic training needed to fit you for any of the positions mentioned above.

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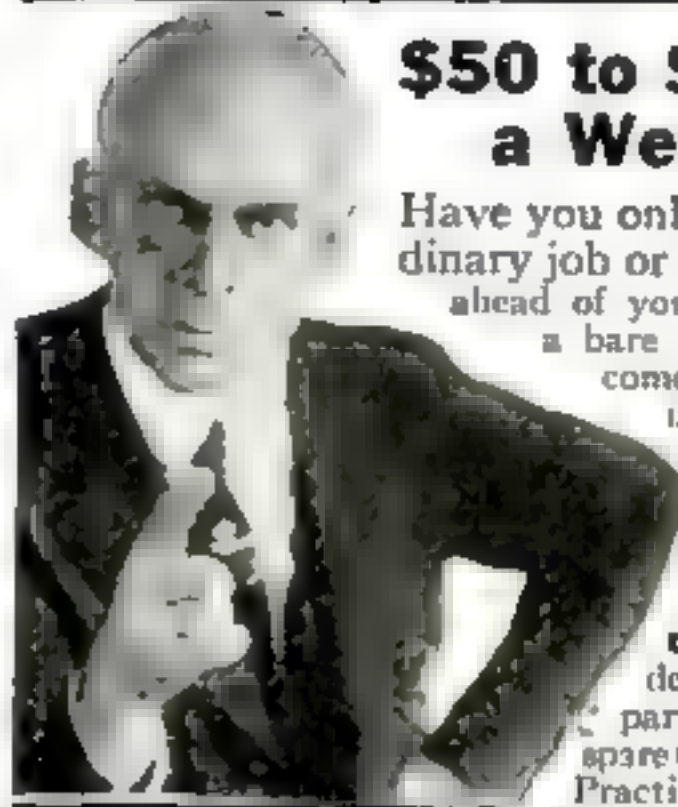
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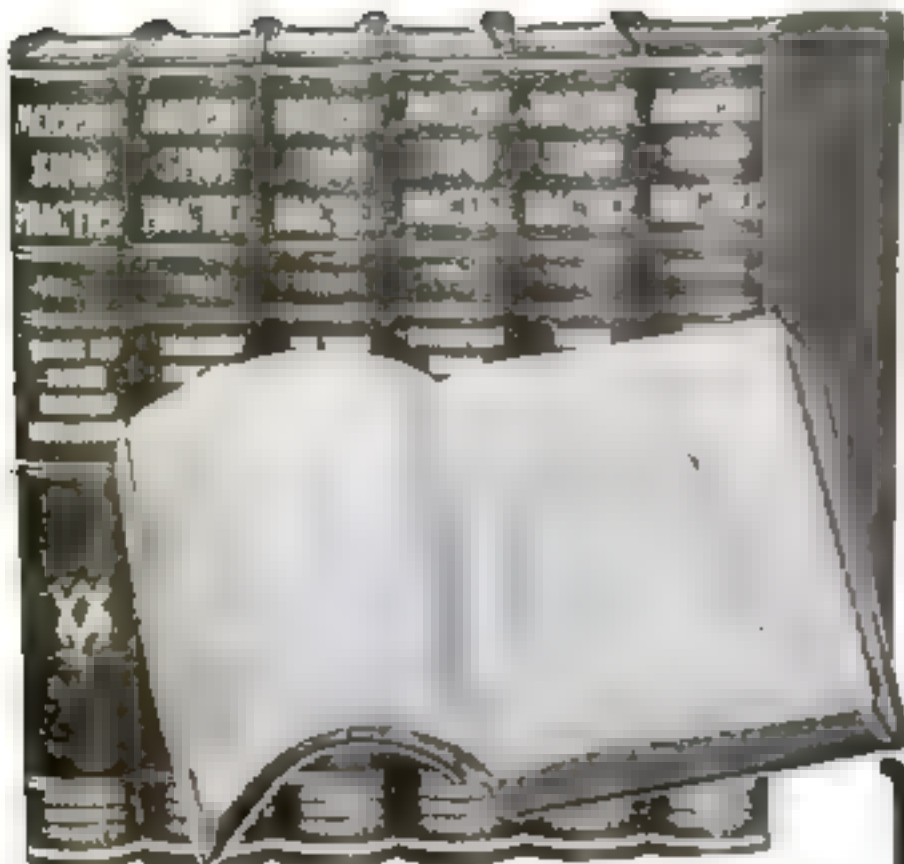
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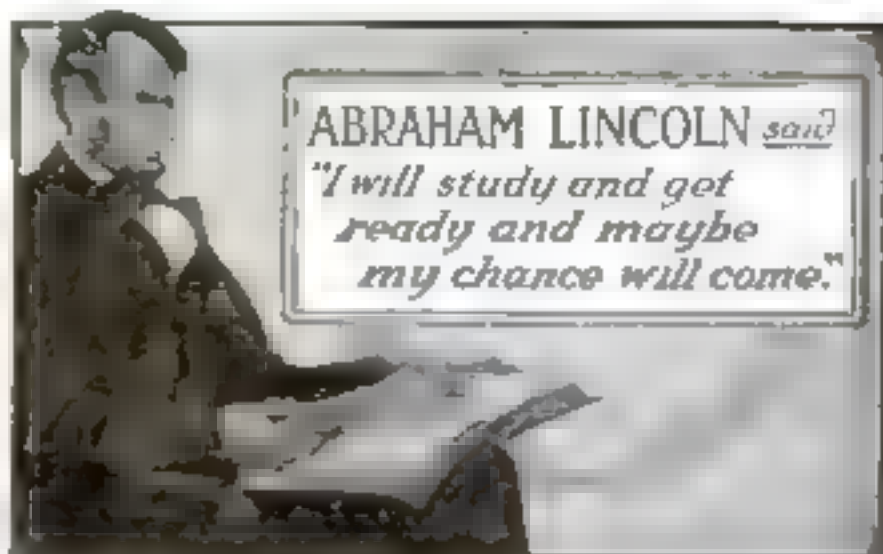
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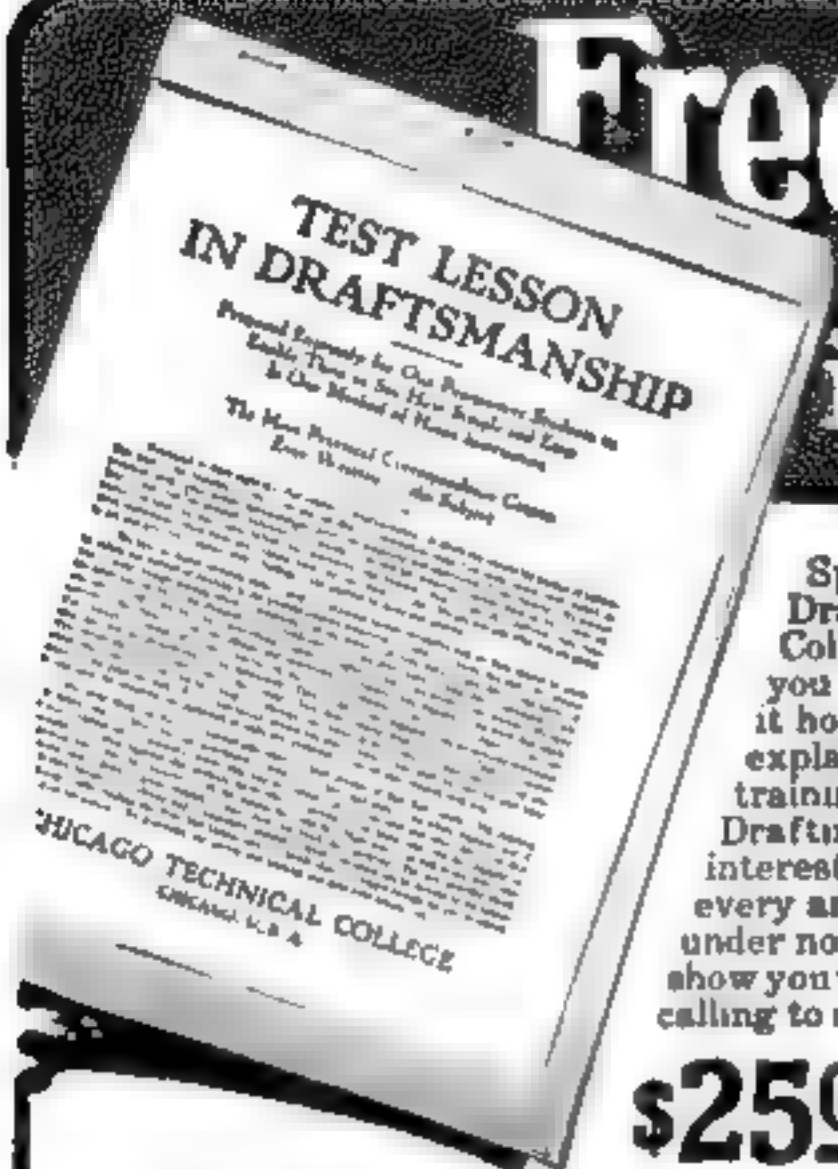
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College or Home Study? State which



To you whose spirit yearns for nature and the great outdoors, the profession of Tree Surgery offers a rare opportunity for a fascinating, challenging and uplifting work with unusual advancement in keeping with the best that is in you.

An offer to train and employ 250 Young Men

BY A GREAT NATIONAL ORGANIZATION

HOW would you like to have a position, as a trained expert, with the largest and most successful organization of its kind in the world—a position that offers you an unusual opportunity to make good in a big way? Where your advancement is limited only by yourself?

That is just the kind of position the Davey Tree Expert Company offers to 250 ambitious young men—to YOU, if you can qualify.

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Owners of this country's most beautiful estates—such men as Rockefeller, Vanderbilt, Astor, Armour, etc.—come to Davey experts for the scientific treatment of their trees.

The demand for Davey service is growing so rapidly that we find it necessary to train for

our organization 250 additional young men.

We cannot secure trained experts from outside sources. The science of Tree Surgery was originated and developed entirely by the Davey company, hence we can add expert Tree Surgeons to our organization only by training them ourselves.

Therefore, we have arranged to train 250 young men this fall and winter—either at their homes in their spare time, or under personal instructors at our Kent headquarters—so that they will be ready to take up their new positions with us next season.

THE OPPORTUNITY OF A LIFETIME

Considered from every standpoint, the profession of the Davey Tree Surgeon is ideal.

His day is a day of fresh air and properly balanced outdoor exercise—a combination that means health and an inspiring relief from the monotony and grime and dust of ordinary work.

His work is not only pleasant, but is fascinating in the extreme, developing in a man mechanical skill and scientific accuracy.

He practices his profession on beautiful country estates and around the finest homes, and conducts his business with men and women of wealth and refinement.

His profession commands the respect of everybody. It is a highly useful and impressive work. The field is inexhaustible, and the demand for real experts who are honest and efficient is increasingly greater than the supply.

He enjoys a rare opportunity to travel and see the best parts of the country with car fare paid. He works with the finest type of clean, American manhood; not molly-coddles, but fine, manly fellows.

He is well paid—responsible men in the Davey organization earning from \$1,000 to \$10,000 a year. And best of all, there is no limit to his chance for advancement. There is abundant room at the top in the Davey organization and everything possible is done to help him get there quickly—merit, and merit only, is recognized.

The Davey organization is built and intensively maintained to give quality-first work always and honest service.

THE OPINION OF A BUSINESS MAN

The following letter was written by Mr. John R. Hegeman, Presi-



W. H. McDermott—At age 20 a clerk in clothing store at meager salary. Joined Davey Organization. Secured complete training. Took advantage of wonderful opportunity which he found and in 4 years became one of the highest paid men in the field force.



D. Q. Grove—A school teacher who found in the profession of Tree Surgery his great opportunity. He had the ability and the zeal. The Davey Organization developed it. He now makes five times as much as formerly. Moreover, he loves his work.



Davey E. Hudson—There is a typical record of success resulting from natural ability and a wonderful opportunity to develop it. He was a farmer boy with a modest education and very small pay. He now earns 20 times what he was making on the farm.

dent of the Metropolitan Life Insurance Co., New York, after his trees had been treated by Davey Tree Surgeons:

"You seem to have an unusual body of men in your service—in love with trees—fond of their work—very intelligent and industrious—doing their work with rare skill and neatness—and altogether worthy of commendation."

THE OPINION OF A MAN OF SCIENCE

A letter from Dr. H. D. House, New York State Botanist and formerly professor at Baltimore Forestry School, after he had seen the Davey organization in convention at Kent:

"After an inspection of the work accomplished by your men and a study of their methods, I am convinced that their work measures up to the highest degree of efficiency which training and experience can produce."

QUALIFICATIONS

If your age is between 18 and 32, if you are healthy, and if you can furnish satisfactory references as to character, you are qualified for training and employment by the Davey company. Unmarried men preferred.

A LIFETIME PROFESSION

We are not seeking men to fill temporary gaps in the Davey organization. We are offering an opportunity to 250 young men to join forces with us permanently if they so desire—in a healthful, fascinating, profitable profession worthy of any man's lifetime work. If you are interested, write quickly please.

WE WILL TRAIN YOU AT THE DAVEY INSTITUTE LABORATORIES

For those who can conveniently leave home for winter resident instruction, we conduct at Kent our own training school. This includes practical field work in addition to several months of intensive class-room training and laboratory work. The instruction is in charge of experienced Davey Tree Surgeons and special scientists gifted in the art of teaching. On completion of this course you will be ready to take a permanent guaranteed position with the Davey organization. For full information about this offer mail the "Resident Training" coupon below.

OR WE WILL TRAIN YOU AT YOUR HOME

For those who are unable to come to Kent for the resident instruction and laboratory work, we have arranged a special course of preliminary home study, followed by thorough, practical training. Each lesson has been as carefully planned for the requirements of home study that you can readily complete the entire course during the winter months. Your home study will not make you a finished expert, let us say frankly, but it will give you such a thorough grasp of the fundamentals of Davey Tree Surgery that your progress will be rapid and certain. In the Spring, after your winter study is finished, we will call you in for practical training and a guaranteed position with the Davey organization. For full information about this offer mail the "Home Study" coupon below.

The Davey Tree Expert Company

2810 Elm Street, Kent, Ohio

Branch Office, with telephone connection: 225 Fifth Ave., New York, 2017 Lane Title Bldg., Philadelphia, 450 McCormick Bldg., Chicago. Permanent representatives located at Boston, Newport, London, Hartford, Stamford, Albany, Rochester, White Plains.

Branches: L. I.; Newark, N. J.; Philadelphia, Harrisburg, Baltimore, Washington, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Louisville, Chicago, Milwaukee, Minneapolis, St. Louis, Kansas City. Canadian addresses: 21 Victoria Square, Montreal.

MAIL TRAINING COUPON

The Davey Tree Expert Co., 2810 Elm St., Kent, Ohio. I am interested in your offer to train and employ men as Davey Tree Surgeons. Please send me full information about your plan of home training. It is understood that this request obligates me in no way.

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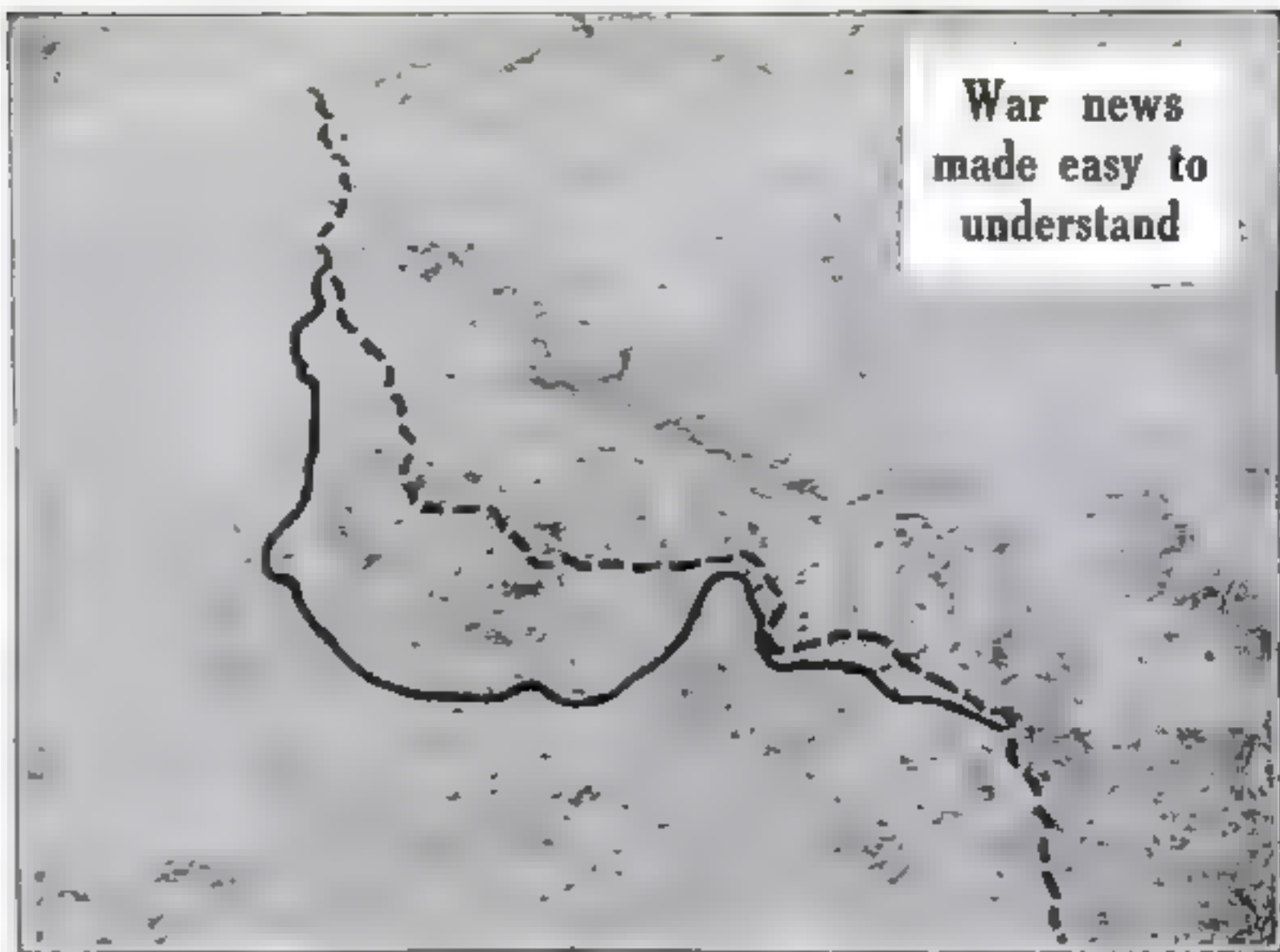
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28 x 36 inches

The photograph herewith is a reproduction of the most complete single map of the Western Front ever published. It is 28 x 36 inches in size, but folds into a convenient cover 5 1/2 x 7 1/4 inches, just right to be carried conveniently in the pocket for frequent consultation. It is printed on excellent paper, and can be had mounted on cloth if desired at slight extra cost.



The Most Complete Single Map of the Western Front

More than 7,000 Villages, Towns, and Hamlets

On this map there are shown more than 7,000 places. The State of Illinois contains about the same number of square miles as shown on this map and in Illinois there are less than 1,700 places of 100 or more inhabitants. In addition to this vast number of places it gives all woods, fortresses, fortified towns, naval arsenals, forts, redoubts, batteries, aircraft depots, wireless stations and railways. The forests and woods are indicated in green, giving the map an attractive appearance, and adding a strategical feature of importance. The scale of the map is 10 miles to the inch. It extends west to Ashford, England; north to Antwerp, Belgium; east to Frankfurt, Germany; and south to Orleans, France. It shows for comparison the battle line of 1914, when the Germans were almost at the gates of Paris. The ground gained by the Allies therefore, may be plainly seen. It is without exception the most satisfactory map of the Western Front which has been engraved. It has been prepared especially to throw light on movements as they occur. It may be examined with ease, for the type is bold and clean cut.

A Complete Index Makes Locating Easy

An index of towns and villages accompanying a map of this kind has been proven an *absolute necessity*. The smaller towns are the ones usually mentioned in the news dispatches. They are not to be found on ordinary maps, and the locations, of most of them were, and still are, utterly unknown to the general public, but unless

Follow the
American
Troops in France

their locations are known their strategical importance cannot be grasped.

Nothing is more unsatisfactory than searching all over the map for a small place that may or may not appear upon it. However, this loss of time and patience is now at an end, for the index which accompanies this map makes it vastly more useful and valuable. The index contains more than 7,000 names.

An idea of the importance of this statement may be gained from the fact that 90 per cent of the war maps available to-day contain less than 500 names. This index is bound in with the map and enables one to locate instantly any one of the 7,000 places mentioned.

Sent on Approval

The great value of this map is so apparent that a copy will be sent on approval. If, after examining this map, you decide not to keep it, your \$1.00 for the plain, or \$2.00 for the cloth backed map will be refunded promptly. Mail the coupon or write a letter now to Nelson Doubleday, Dept. 1210, Oyster Bay, N. Y.

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Popular Science Monthly,
239 Fourth Avenue, New York, N. Y.

Aimed and Fired by Mechanism



The machine gun is nearing the zenith of its perfection. The coming weapon will be mechanically aimed, controlled and fired from a distance so that the crew may crouch in their dug-out, observe the foe through a periscope, and fire without exposing anything but a nerveless, fleshless mechanism of steel

Popular Science Monthly

239 Fourth Avenue, New York City

Vol. 91
No. 4

October, 1917

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Is This the Machine-Gun of the Future?

The men are concealed and the trigger is pulled by machine; the barrel is cooled like an automobile engine; the ammunition supply is continuous

By Edward C. Crossman

MACHINE guns talk in stutters—staccato stutters. They can fire at the rate of six hundred shots per minute, but they can't keep up the pace. Part of this failure is due to the fact that the ammunition containers are limited in capacity, part is due to the fact that the very first rattle of shots jars the gun off the mark, unless the mark be a very large one. The gun must be "relaid," before fire is resumed. Also, there is the fact that a continuous fire in any sort of machine-gun, water-cooled or air-cooled, would ruin the bore. The great heat of powder gases (more than four thousand degrees) results in a washing away of the steel of the barrel in short order when the fire is continuous enough. The chief reason, however, for this break in fire continuity is the necessity for re-aiming the gun every twenty or thirty shots unless the mark is practically unmissable.

What the machine-gun could use very nicely are these little things: A mount with possibly a recoil absorbing mechanism to prevent the gun from jarring off the mark; a better cooling system than the ones now used—in which the water boils away and the air doesn't cool; a device for continuous fire for certain conditions; mechanical control of the firing, the feeding, the elevating, and the traversing

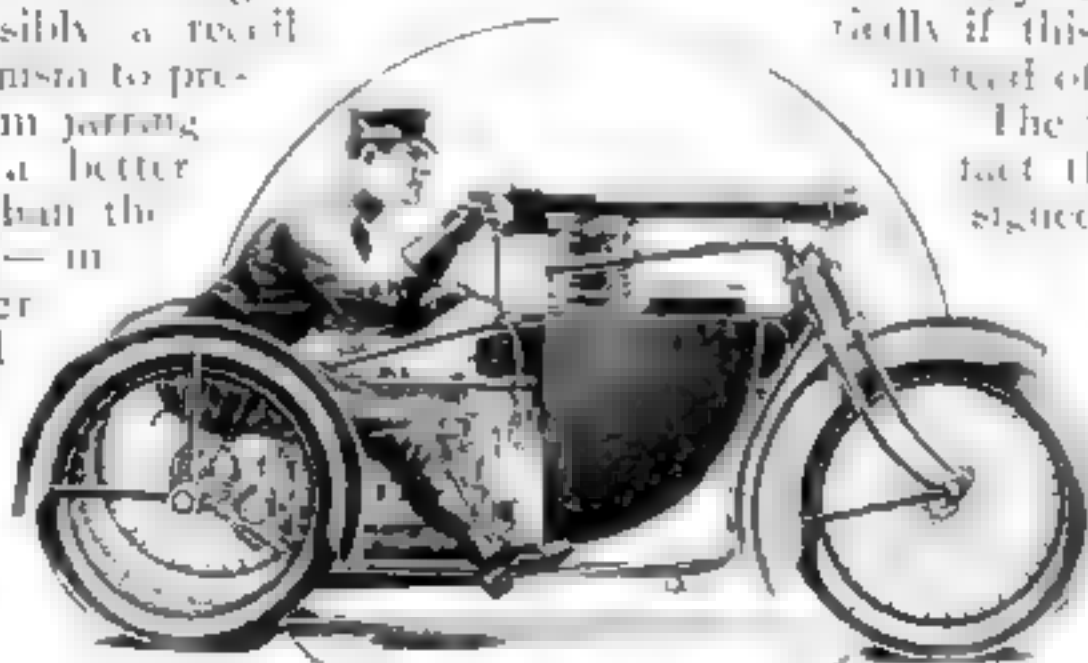
mechanism of the gun, so that the crew can operate it in safety, from a distance.

There comes now an inventor with the significant name of Ford—not Henry, however—with some startling improvements for the machine-gun.

The first one is a mechanically operated loading machine to keep the belt of the gun filled all the time, regardless of its speed of fire and the duration thereof. The belt-loader is operated by the power of the machine on which the gun is mounted, this to be motorcycle, motor-tricycle, automobile, airplane or other power vehicle.

The second is a circulating water-cooling system, *à la* automobile, in which the water passes from the jacket around the gun-barrel to a regular automobile radiator, which in turn is cooled by a fan driven by the power that operates the loading mechanism and which in turn is merely the power plant of the car. A centrifugal pump makes the water move, although it would surely thermo-siphon hurriedly if this system were used instead of the pump.

The third startler is the fact that the gun is designed to be an integral part of its carriage, which is a gas engine propelled vehicle. Perhaps this idea was borrowed from the fighting airplane, in which the machine gun is rigidly mounted to fire through the propeller.



© A. S. Ford

The belt-loader on this machine-gun is operated by power from the motorcycle on which it is mounted

If You Lisp or Stammer Train Yourself with a Mirror or a Candle

LISPING and stammering are separate imperfections of speech which require entirely different treatment.

Lispers, for instance, can be cured in a short time by tongue and palate gymnastics. They "lithp" simply because they do not work their tongue and palate properly. By making the child speak before a mirror, however, the teacher can correct these mistakes.

Stammering is a nervous disorder which cannot be cured so easily. The pupil involuntarily applies too much force at certain parts of the vocal organs, causing the stuttering and a sputtering with which we all are familiar. The cure is to relieve the over-worked parts by distributing the energy evenly. This is learned by pronouncing certain flowing sounds in front of a candle until the flame does not flicker.

graphic plate only one such impression, or image, can be obtained. With the motion picture film, however, a fresh piece of film is continually exposed to the lens.

Just such an arrangement exists in the human eye. An emulsion called visual purple acts as a film of great latitude, renewing itself as soon as it is struck by the light and discolored. It adapts itself to various intensities of light, protecting the retina from too brilliant a glare at all times.



Above: Practising breath control with a candle flame. Below: Tongue and palate gymnastics before a mirror

The Original Motion Picture Film—It Is in the Human Eye

THAT the human eye and the photographic lens are very much alike in design and operation is a well known fact. If you look through a photographic lens you will see nothing clearly. To perceive the image a piece of ground glass or a plate of film is necessary. A plate is a piece of plain glass which acts as a support for an emulsion. This emulsion decomposes when struck by light, and the decomposition is made visible by a process called development. With an ordinary photo-

and ratchet device at the side. The person who wishes to increase his or her height is fastened in the machine and the stretching is done by turning the ratchet.

It is extremely doubtful if the machine illustrated could do more than exercise the neck and abdominal muscles.

A Self-Inflicted Tug-of-War to Increase Your Height

TO increase the height by a stretching process, to vivify the spine and stimulate the nerves—these are the purposes of an odd machine known as the pandiculator, invented by a chiropractic specialist for use in the practice of that method of treatment.

The apparatus is simple, consisting of a couch with a headpiece and a foot rest that can be extended by the operation of a cog



After you are strapped in the machine you stretch yourself as strenuously as you like by pulling the ratchet device at the side

Fiber Containers Take the Place of Tin Cans for Preserved Foods

TIN is scarce. Imports have decreased, due to reduced production and poorer shipping facilities. "Ready-to-eat" foods are prepared in the containers; hence they require tin cans. Many foods, like ripe olives, jams, and spices, can be packed as well in glass jars. But the price of glass is steadily rising.

To conserve glass and tin, containers of fiber or paper are being made in increasingly large quantities. They come in various sizes and shapes adapted to different uses. Most of them are coated with paraffin, which prevents leakage and helps to make the container airtight and to keep it board-stiff.

Fiber containers can be recommended for cream, oysters, syrups, dried fruits, jellies, mincemeat, horseradish, pickles, deviled ham, chicken, vinegar, mustard, sauerkraut and olives.



With this combination knife and fork a wounded man can cut and eat his food without assistance

The Umbrella Hat—It Was Invented Years Ago by an American

THE umbrella hat is not a recent invention, but was familiar years ago to the residents of Seattle, as the particular head-gear of Robert W. Patten. He was a picturesque figure on the city streets, and he always wore the hat which he invented while mining in Mexico.

The hat is mounted on a frame which fits closely around the head and branches out in ribs like those of an umbrella. Originally, netting was draped around it to keep off the mosquitoes. The umbrella portion could be tilted to any angle.

Although not as wide as an ordinary umbrella, when used with an all-enveloping rain-coat, the umbrella hat keeps off the rain as well as if it were larger. The idea has been adopted in a modified degree by farmers.



The umbrella hat can be tilted at any angle to keep off the sun

A Combination Knife and Fork for the Wounded

EVEN the ordinary tableware is undergoing changes and improvements to meet the needs of the soldiers who have been wounded. The accompanying illustration shows a combination knife and fork which will enable a man to eat in comfort without having to call on some one else to cut up his food.

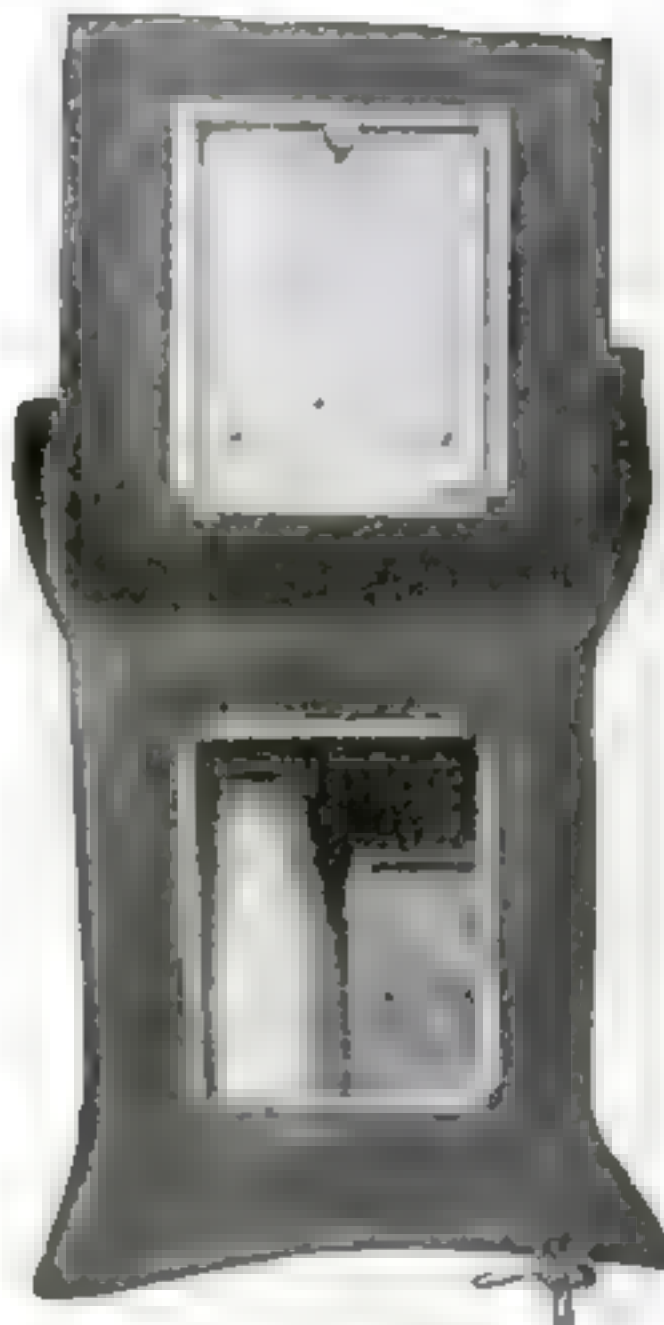
The knife blade is equipped with a bone handle at one end, and at the other it curves up and around and ends in four prongs like those of an ordinary fork. The usefulness of the knife for the purpose is evident. Below the prongs is a broad flat portion slightly dented in, to prevent the food from chipping off.

This also serves as a spoon, so that in reality the implement is a combination of knife, fork and spoon. It may be used for everything but soup.

The Makeshift Refrigerators of the Fighters



A refrigerator for one of the National Guard units camped in the East. It is a hand-made affair, constructed of boards and divided into three roomy compartments in which food of all descriptions is stored. The ice is kept in the lower section—when there is any ice. The interior is lined with odds and ends of sheet metal



A knapsack refrigerator for the soldier to carry on his back. The cold compartment is lined with sheet metal and water cools the contents on the evaporation principle. It is not as heavy as it looks, being made of light weight material. The articles carried in it are such as can be soon disposed of



The army "water cow," used by National Guardsmen in New York. The bag is first soaked in water and then filled with water. The sun and wind do the rest by starting evaporation

Training a Horse for One of the Finest Services in the World—The New York Mounted Police



Only men who show a marked aptitude for riding and only horses which respond readily to the rigid course of training, are accepted for the mounted division. This one is a bit unruly

Photo © Int. Film Serv



Teaching a recruit in the business of stopping a runaway. The policeman's mount must run even faster than the frightened animal in order to head him off



Throwing a horse so that a veterinary may work on its feet and legs. The rope is attached to one front and one rear foot, and passed through a ring in the surcingle

An Ounce of Prevention Is Worth a Pound of Cure



Above: Each anchor weighs a ton. A wheeled lever-hoist is necessary to lift the "sinker" - as they are called by the sailors.



Securing the bell anchors to the bottom cables of the nets to be used as submarine protection.

In oval above: Spreading the net. The meshes are very fine and are arranged ten feet apart.

The Anti-Submarine Nets Our Tars Are Making



Left: Men in White Navy.

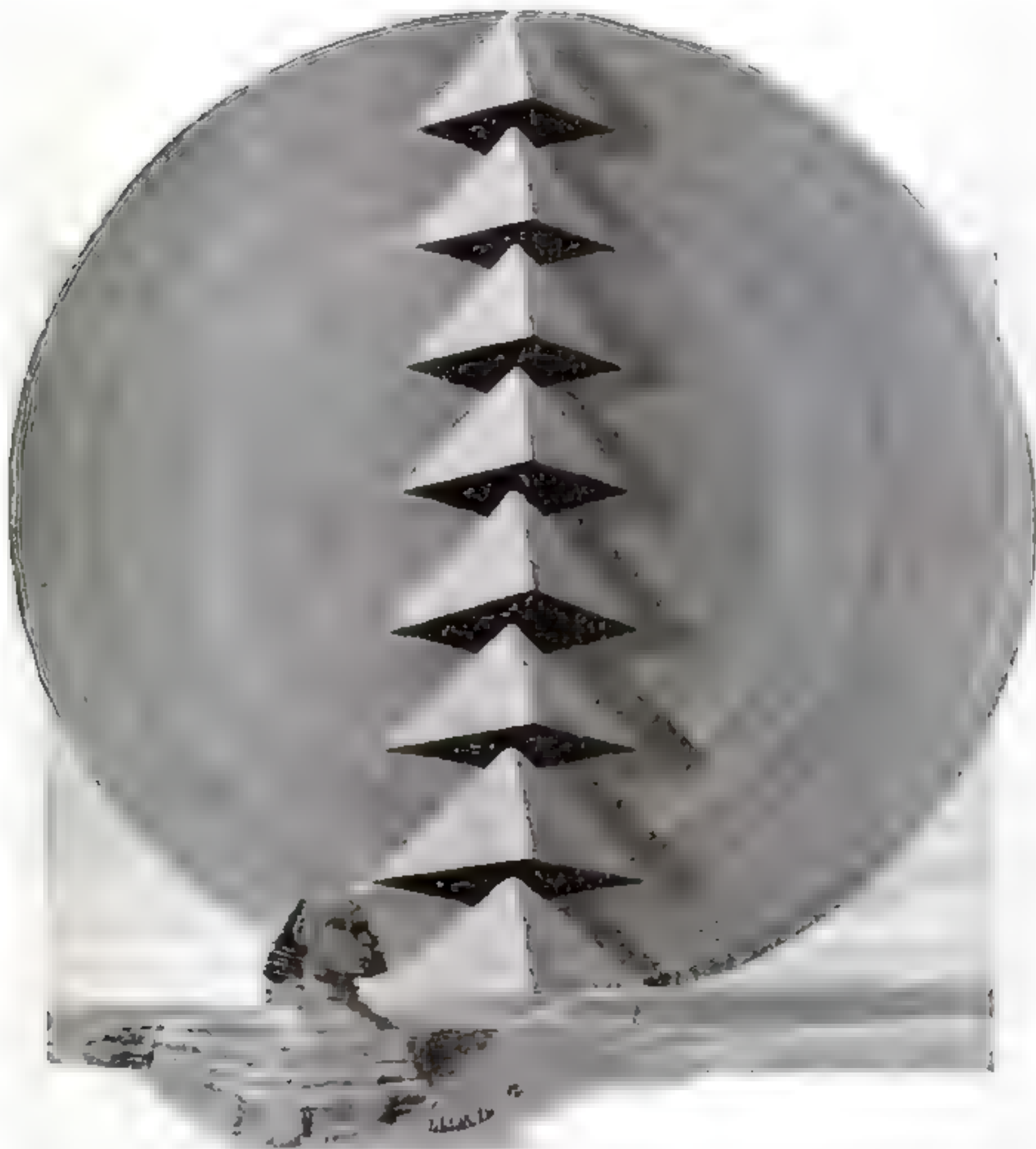
Above: Having been shipped on giant spools, the nets are ready to be rolled upon the barrels which will carry them out to sea

Two members of the Naval Reserve clamping the mesh joints together, the completion of the first stage of net work

Barrels and tanks which will buoy up the finished nets at some strategic point. In the foreground are seen the anchors

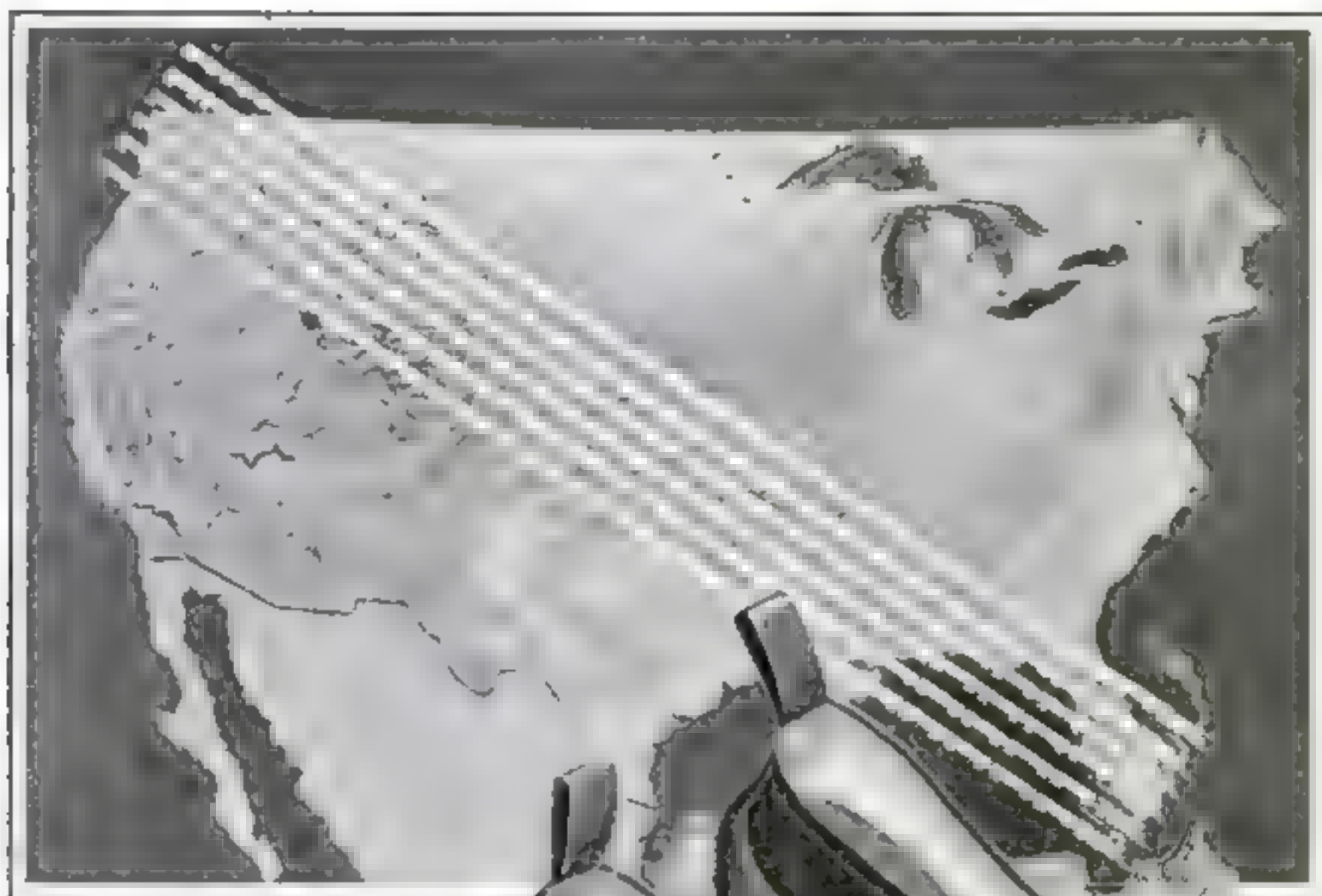


If All the Allies' Army Blankets Were Rolled Together, End to End!

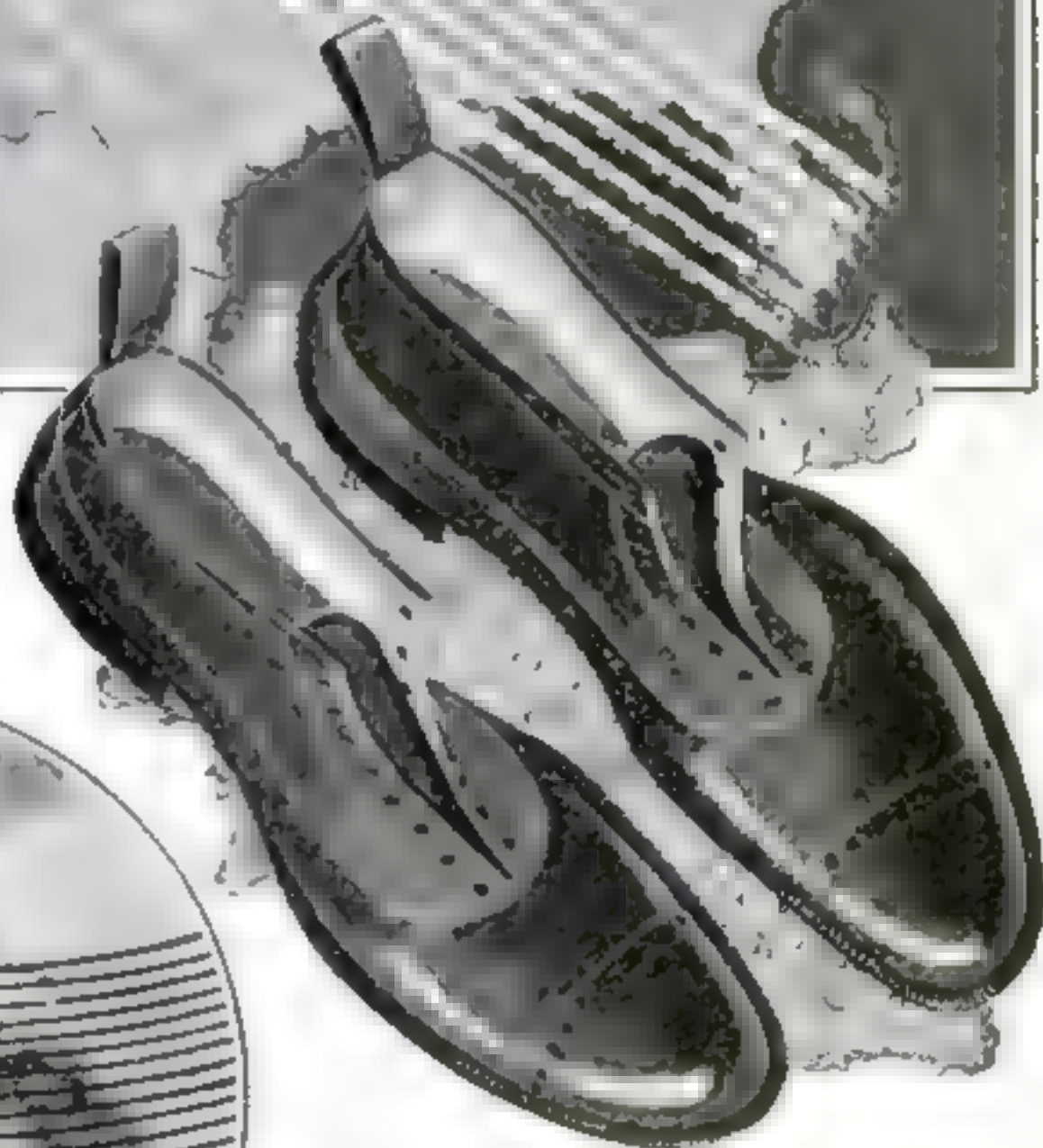


Imagine yourself slowly running your eyes up the four hundred and fifty-one feet of the great Khufu pyramid in Egypt. Do not stop at the top, but picture if you can, seven more pyramids of equal height placed one upon the other above the real one. In back of these imagine a great roll of wool and cotton whose prodigious diameter stretches from the ground to the peak of the top-most pyramid. Your mental picture will be like this one, and it will represent the miles of blankets that have been used in the equipment of the Allied armies from the beginning of the war until our entrance into it. And this enormous amount of material is only one item of the equipment! Such comparisons are useful in bringing home to the lay mind some idea of the total cost of the war in dollars and cents as well as in the consumption of products and the output of factories.

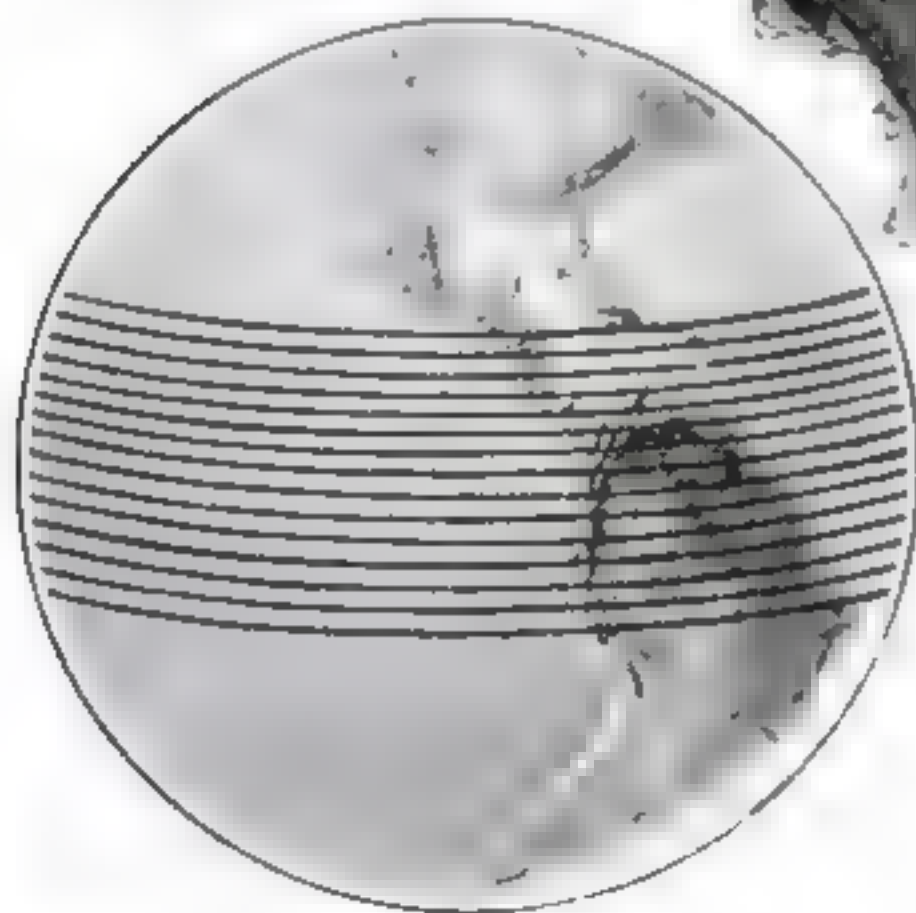
What It Means to Feed, Shoe and Clothe the Armies of the Allies



The food that was transported during the first thirty months of the war to the Allies would fill six lines of freight cars, stretching from the State of Washington to Florida



Our first equipment order was for four million two hundred thousand pairs of shoes. If a pair could be made that number of times the size of the ordinary pair, it could "press under foot" all Germany and Austria



Up to April of this year, the Allies had used up six hundred and thirty-three million yards of cloth in the making of their shirts and uniforms. Such a strip could encircle the earth fifteen times, covering about 375,000 miles

France Patrols the Blistering Sahara with Airplanes



Underwood and Underwood

A remarkable photograph taken of the Sahara Desert and part of the town of Guemor from an airplane. Look closely and you will see that almost all the houses are fortified with high walls. There have been several outbreaks in this region, several nomadic tribes taking up arms against the French. But the French have been able to patrol the whole district, three times as great as France, without losing a trooper

Indian Art Is Not Limited to Basketry

The Indians of South America are so intermixed with the Spanish and other Europeans that there are few true to type. But in the mountain regions there are many reminders of the primitive tribes. At left is shown a group of images of Colombian peasants carved from Seiba wood. These little figures are made in great quantities by the young girls of Bogota, Colombia. They are very accurate in details of costume and expression. Types such as these are common among the tribes in portions of the upper Andes



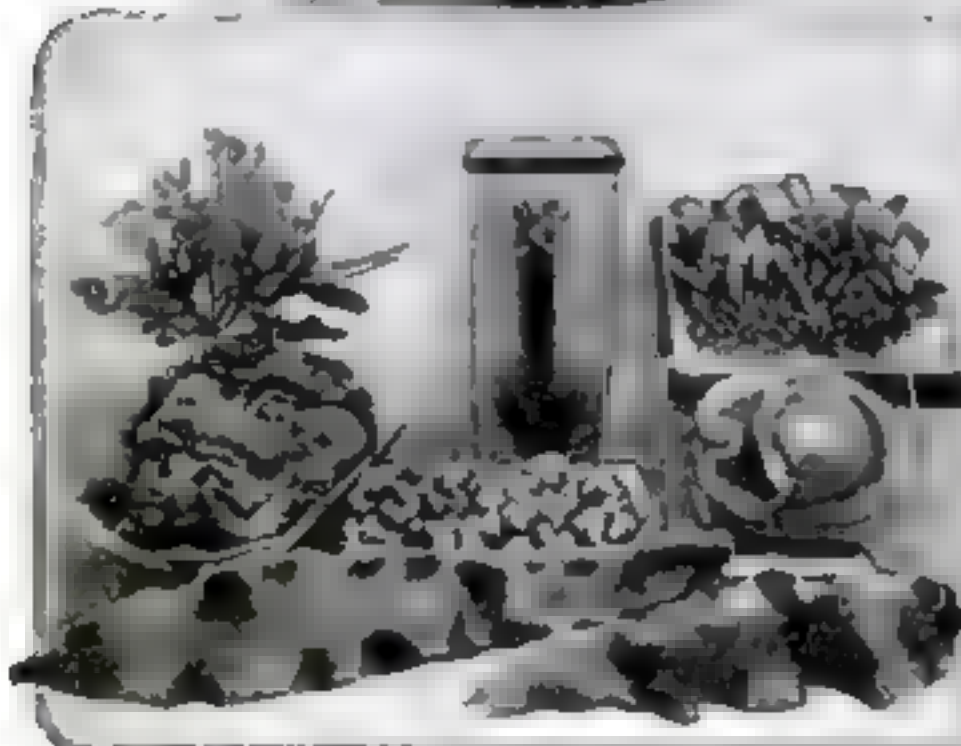
The South American Indians are adept at making pictures out of feathers. Above is shown a bird scene fashioned entirely from feathers of tropical birds. It represents twelve days' steady work



At left: Statue of a Colombian peasant woman. It is molded from a peculiarly hard wax which does not melt even in the tropical heat. The costume—even the cigar—is typical of the Chibcha Indians

Food—Food—Everywhere If We Would Only Eat

Painting a life-like model of a snake—not for exhibition in a museum but for illustrating the many foods we don't touch. Shall we ever eat snakes? Once upon a time ox-tails and calves' feet were considered useless



By Anne M. Newcomb



Photos © Crown Illus. Serv

Above are some unutilized foods of our seashore—kelp, kelp, mussels, squid, periwinkle and sand collar snail. Ever eat any of them? If they tasted good recommend them



This artist of the kitchen makes pleasing pictures of real fruit framed in baking tins

Can a man be well fed on twenty-five cents a day? Above are three tables set for breakfast, luncheon and dinner at a total cost of twenty-five cents

Hell Fire Up to Date



© Kadel and Herbert

A remarkable photograph of French troops repelling a German attack with liquid fire. The apparatus consists of a metal cylinder strapped on the soldier's back, a metal hose pipe, and a nozzle to which is attached a wick, lighted before the attack begins. The cylinder is divided into two parts—the upper half filled with compressed hydrogen and the lower half with a mixture of burning and lubricating oils. The flame projected is thirty feet long and about five feet in diameter, and the conflagration spreads rapidly over a wide area.

Dolling Up Your Ford



A mirror carefully adjusted like the one at the side of this car will prevent rear collisions



A choke coil which gives a good strong illumination at seven miles an hour without burning out the lights when going at twenty-five miles

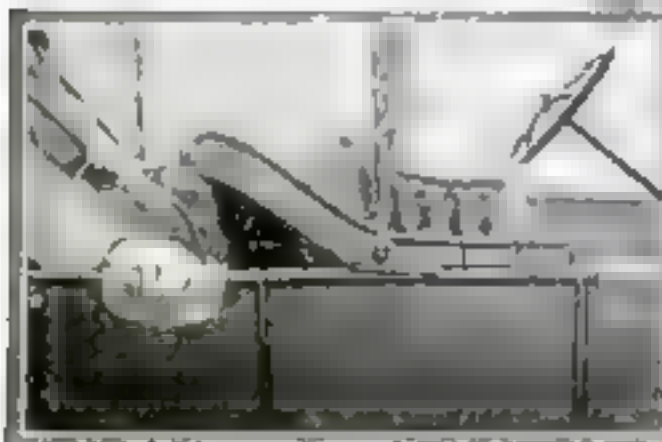
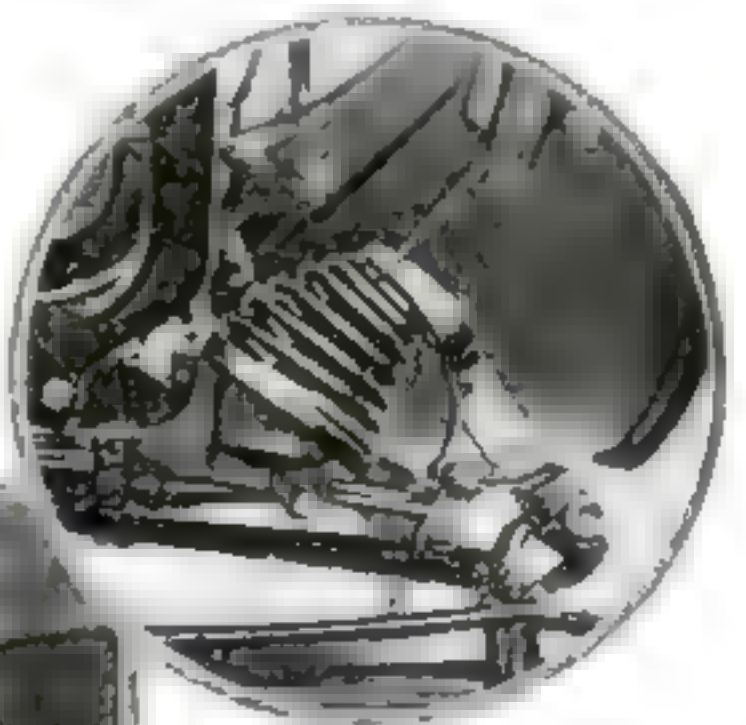


Rubber running boards are very convenient—at fifteen dollars a pair, thank you. But they wear well and are very easily kept clean



Here we have one of the few men who know where every Ford accessory belongs. He is showing you a decoy instrument board to humiliate your pocketbook, and a new-fangled automatic gage device for the gasoline tank

Below: Rubber foot pedals are easy on the shoes and sometimes prevent your foot slipping when you apply the brakes quickly. They are said to reduce vibration



Hand guards for doors eliminate ugly spots on the woodwork and break up the straight line at the side of the car



A good shock absorber which prevents you from bouncing out of the car when it strikes a particularly resistant obstacle. It is probably the simplest device for the purpose on the market

Dolling Up Your Ford



Every carburetor is better than the Ford one—so the papers say. This one gives 37 miles on a gallon and revels in kerosene



A runabout with \$311.50 worth of accessories on it. It runs under its own power!



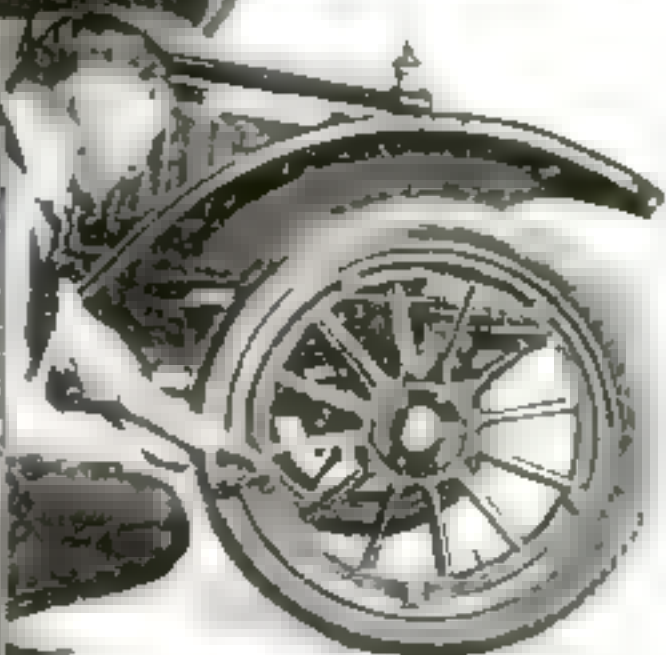
A set of gears for the driveshaft. It gives four speeds forward, a lower high gear than the Ford high and a lower low than the Ford low

At right: A slip to go between the windshield and the top, to prevent drafts from sailing down the necks of folks in the tor-seau



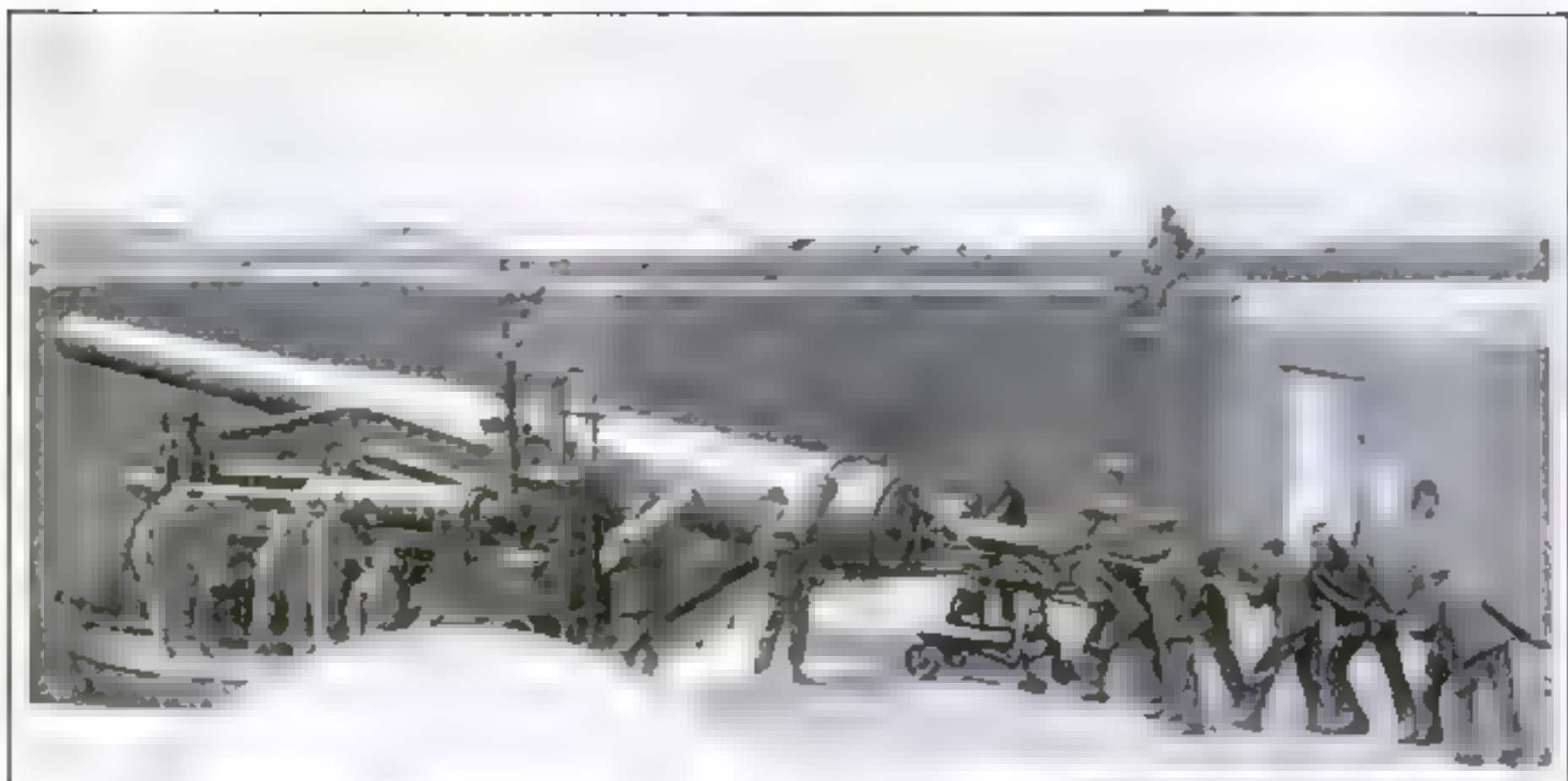
The Ford radiator cap is too typically Ford, and burns the hands at times. Better replace it with a cap of this type

The robe rail costs from seventy-five cents to \$1.35 and it keeps the interior of the car neat



The demountable rim graft—a pound of weight below the springs is as bad on tires as four pounds above

"Count Every Shot and Make Every Shot Count,"



Loading one of our coast defense guns. Coast artillery is charged with protecting places of great strategic or commercial importance against naval attacks

At left: The breech of the big gun thrown open to receive a shell, several of which are mounted on trucks specially provided for that particular work



Is the Order Given to the Coast Artilleryman



A big gun at the moment of firing. It has been elevated into position before firing, and immediately afterward it falls back out of sight on its supporting members. The two-ton shell it has hurled off into space can penetrate the thickest armor of any battleship that may dare to poke its nose within a dozen miles of our coast.



"Tactics change every ten years," said Napoleon. Before the war our coast artillery was practising at ten thousand yards; now the range has developed into twenty thousand yards and more. The energy necessary to fire a shot from the gun in the picture continued from the preceding page would project your two-ton automobile twenty-seven miles in less than twice as many seconds.

Building the Foundation for a Wasp Empire



© Brown and Dewar

Queen wasp working upon her first spring nest. The queens hibernate in the fall and lay the foundations of wasp empires during the first days of spring. The first nest is constructed from paper worked up in the wasp's jaws from vegetable substances. She fashions six or eight six-sided cells and lays an egg in each. These quickly hatch out and the larvae are fed on honey and insects

The First Stage in the Life of a Wasp



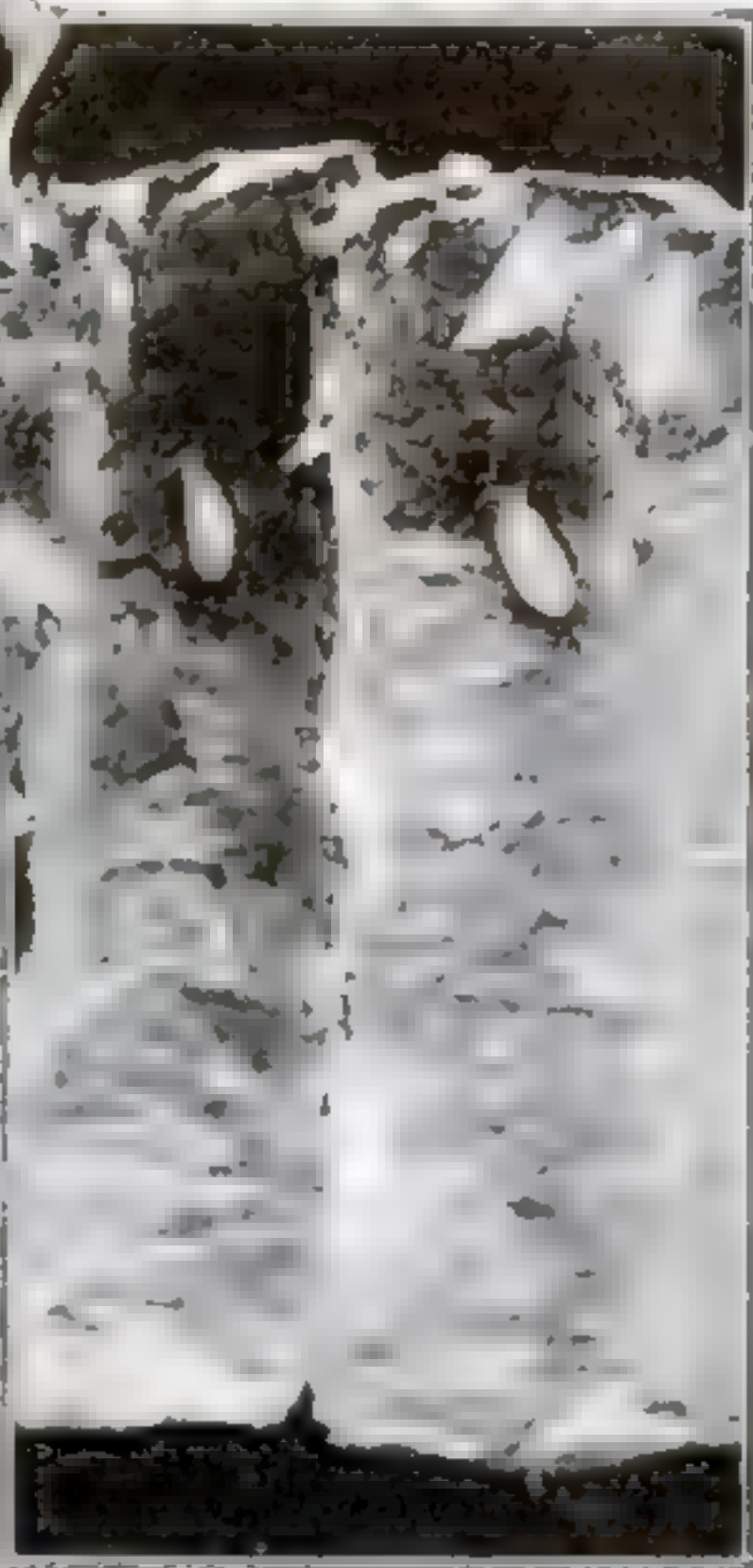
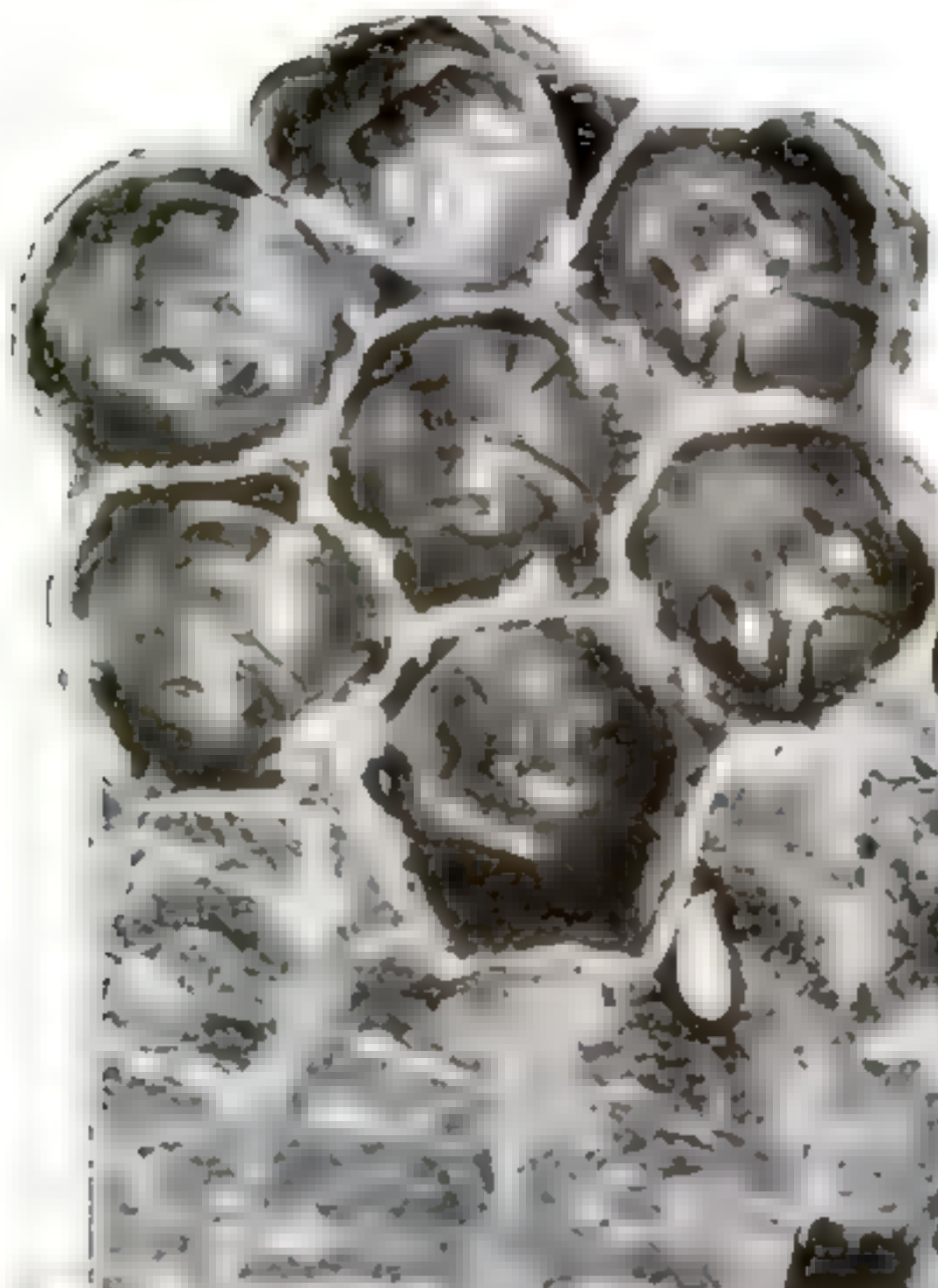
© Brown and Dawson

Queen in the act of laying an egg in a newly constructed cell. The nest of this type of wasp is usually found suspended under the overhanging roofs of buildings. The larvae remain in the cells until they reach the "pupa" stage. Then the cell is sealed up with the pupa inside. It evolves finally as a young wasp or "worker"

Three Stages of Growth in a Wasp Colony

The front of a wasp's nest is seen at the left. The nest has grown to an empire, many broods having been raised and each in turn having labored to increase the colony. In each of the cells the face of a young wasp almost developed peeks out.

Below are shown cells of the wasp's nest, cut open to reveal the eggs as deposited by the Queen. The cells of a nest are not allowed to remain open—soon as one wasp emerges, the cell is closed out for another egg. The young wasps are the workers.



Section of a wasp's nest showing on the left a young wasp still in the feeding stage and on the right a wasp that is nearly ready to issue into the world and take up the work of the empire. In the fall the nest grows to great proportions. At length the old Queen dies, and the young wasps fly away from the home.

Choosing Your Suit of Air

A problem in scientific ventilation and how it is being solved by some interesting experiments

By George T. Palmer

Chief of Investigating Staff, New York State Commission on Ventilation



Arrangements for measuring and distributing the flow of air in a schoolroom. The room seems to be free from air-consumers, but it is not. Under the conical hoods are lighted candles which give off heat and use up oxygen at about the same rate as an equal number of pupils

A PROPER "suit of air" is just as important as a serviceable suit of clothes.

A "suit of air" is not imaginary. It is a fact. Our bodies are entirely surrounded by air. Out of doors we can make the air fit us pretty well by taking off or putting on more clothes, or by moving about if necessary to keep warm. Indoors, however, we have not so many privileges.

This finding of the proper suit of air does not sound so difficult; for we are familiar with electric desk fans in summer and large ventilating blower fans in winter which blow large volumes of air through an entire building. But if the problem were simple our workshops and places of amusement would not have air that makes us feel bad.

The New York State Commission on Ventilation is engaged in studying this

problem of ill-fitting air-suits. The funds to support the work are given by the New York Association for Improving the Condition of the Poor. This Commission believes that the way to improve on the ventilation of our buildings is to find out first what good ventilation is, to find out what the human body in its different activities needs. With these facts known, it is then necessary to learn how to produce the good conditions and avoid the bad.

What Is Good Ventilation?

The first step in finding out what is good ventilation, is to measure the effect of different kinds of air on people.

The body is likened to a steam engine or an automobile. The appropriate fuel is supplied and the combustion of this fuel with oxygen produces energy, some of

which appears as heat and some of which appears as motion. The body can be thought of as an engine with steam up, with the fires constantly burning while life lasts.

This fire keeps the body very close to a temperature around 98 or 99 degrees Fahrenheit, which is much above the average outdoor temperature.

Now with the fire constantly burning, it is evident that heat is continually being given off. Through the lungs the gaseous products of combustion, carbon dioxide (and along with this a good deal of oxygen also, for the body uses only a part of the oxygen that is breathed in), are also constantly thrown off. But the body keeps its temperature constant by means of a wonderfully complicated temperature control system.

The Commission set about studying the effect of the various factors of the air on this heat eliminating, gas producing, human engine by placing people, as shown in one of the accompanying pictures, in a specially built experiment chamber, a room connected with steam coils, a refrigerating plant, moisture producing apparatus, ventilating fans and various other devices for altering the condition of the air. The great advantage of this experiment chamber over the ordinary room is that each of the various air factors—temperature, moisture, etc.—can be controlled and varied at will. In a crowded theater, for instance, as the air gets warmer it also gets more moist and begins to have a "crowd" odor. In the experiment chamber the temperature can be hotter while the moisture remains the same, or the moisture can be increased while keeping the temperature the same. In this way each of these various factors can be separated and studied independently.

The Commission paid people regular salaries to stay in this experiment chamber. First these people, or subjects, would be exposed to one condition for a day or a

week and then to another. They wrote down on paper just how they felt. But their opinions on personal comfort were not sufficient. It is also desirable to know whether people can do better work under one condition than they can under another,

not merely physical work, but mental work. And are they as healthy in one condition as they are in another? Is it variations in temperature that have the greatest influence on health and efficiency? Is it variations in moisture?

Nearly four years have been spent in getting the answers to these most important questions. Over two hundred different people—men and women, college students, clerks, typists, truck drivers, boiler makers, firemen, the robust and the weak, the large and the small, the clean and the unclean, have spent some portion of their time—from one day to six weeks—within the experiment chamber. To observe and study the effects of the various air factors on these subjects the Commission has employed a corp of trained observers,—psychologists, physicians, physiologists, chemists, sanitarians, bacteriologists, and engineers who have recorded with scientific exactness each shade of difference observed in the separate individuals.

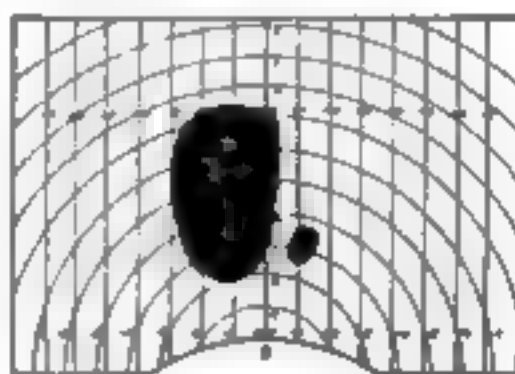
The Findings of the Jury of Specialists

In the first place, they have found that so long as the room was *kept cool*, that so long as the *temperature was not allowed to rise*, it did not make much difference whether or not a plentiful supply of fresh air was supplied to the chamber.

Even when the subjects spent a whole day and six days in succession in the unaired chamber, breathing air that contained the accumulated products of the breath, they did as good mental work, felt just as happy, and did as much physical work as they did when the ventilating fans were constantly changing the air. Furthermore, the most careful observations of the



Measuring the size of the breathing spaces in the nostrils by breathing gently on a cold metal plate



The overheated air in the room has caused the bone in one nostril to swell

heart and circulation and the general condition of the body failed to show any harmful effects. The only indication of any depressing effect of breathing this confined and several times used air was that about five per cent less food was eaten.

The decreased appetite was not due to any accumulation of the gas carbon dioxide; for, when large quantities of carbon dioxide from a tank were added to the fresh air being blown into the room, the appetite was not reduced at all. It is improbable that any poison from the breath affected the appetite, for many elaborate experiments on this point have failed to show the existence of any such poison in the human breath. It is possible that what affected the appetite adversely was a slight odor of sweaty clothes or decaying teeth, which odors are the natural outcome of the continued occupancy of an unventilated room.

The above statement should be carefully scrutinized and re-read. This finding does not mean that fresh air is of no value. Fresh air is of the utmost value, as can be shown by a wealth of examples. What this does imply is that the good effects of fresh air are due more to one of its components—*cool temperature*—than to another component, *chemical purity*. Conversely, this finding indicates that the unrefreshed air of an occupied room whose temperature is not allowed to get too high, does not produce unfavorable effects on the mind, the comfort, or the various organs of the body.

On the other hand, that this re-breathed air, even though cool, is not entirely without some effect, is indicated by the fact that the subjects unconsciously ate slightly

less. In this connection it should be borne in mind that in producing even this slight effect on the appetite the accumulation of re-breathed air in this experiment chamber was from three to twelve times as great as that found in an ordinary badly ventilated schoolroom.

Compare this experience as to re-breathed air with the effects produced by over-heating, even slight over-heating; that is, an increase of temperature from 68 to 75 degrees. At these temperatures, and with the subjects dressed for fall or winter weather, the heart beats faster; the body cannot get rid of its heat as readily and the heat accumulates thereby, causing the body temperature to rise sometimes a degree or more. The subjects feel uncomfortably warm; they do less physical work.

One experiment showed 15 per cent less work done at 75 than at 68 degrees. The appetite, however, remained about the same and the mental work was unaffected even by air hot enough to cause profuse perspiration and very evident discomfort.

As compared with the chemical purity of the air, then, the variations in temperature have been found to pro-

duce a very much more pronounced effect.

The Nose Is a Pretty Good Judge

Now, in addition to these effects, over-heated air, or air which is warm enough to cause people, as they are dressed, to feel uncomfortably warm, also produces a very evident effect on the nose. There is a most peculiar spongy bone in each nostril, called the turbinate bone. This bone has the power of expanding or contracting. When it contracts so as to occupy very little space there is a wide clear passage to



Testing the pulse and blood pressure of workers and of reclining subjects under the same air conditions

breathe through, but when it expands it may become large enough to close up completely the breathing space in that nostril.

It was found that warm air, from 80 to 90 degrees, has a tendency to make this turbinate bone expand. Warm, moist air is apparently more likely to do this than warm dry air. The man in one of the pictures is breathing on a cold, shiny metal plate. The moisture in his breath condenses, is turned into water droplets on the plate and makes two little impressions whose size gives some idea of the breathing space. The black areas of the chart show that in this case the heated air of the room caused the turbinate bone in one nostril to expand considerably more than that in the other nostril. While this appreciably lessened his breathing space he was not so oppressed by the closeness of the room as he would have been if both nostrils had been affected to the same extent. This fact is of importance because this swollen or congested condition of the turbinates and adjoining membrane, accompanied as it is by increased secretion, has a good deal to do with catching of colds. The physical sensation resulting is like that of a cold in the head.

Why Even Warm Winds Are Cooling

The reader may be tempted to inquire why, if heat has such a pronounced effect on the body, we are not all sick in the summer time. The answer is that we are not all sick in the hot summer weather simply because we have means of keeping our bodies cool—as cool or actually cooler than when indoors in the winter time.

In the first place the body produces less heat in summer. In the second place, we wear lighter weight clothing in summer.

By reason of the excessively high temperature of the air about us in summer—80 to 100 degrees—our bodies are caused to perspire much more freely than is the case in an atmosphere of 70 degrees indoors

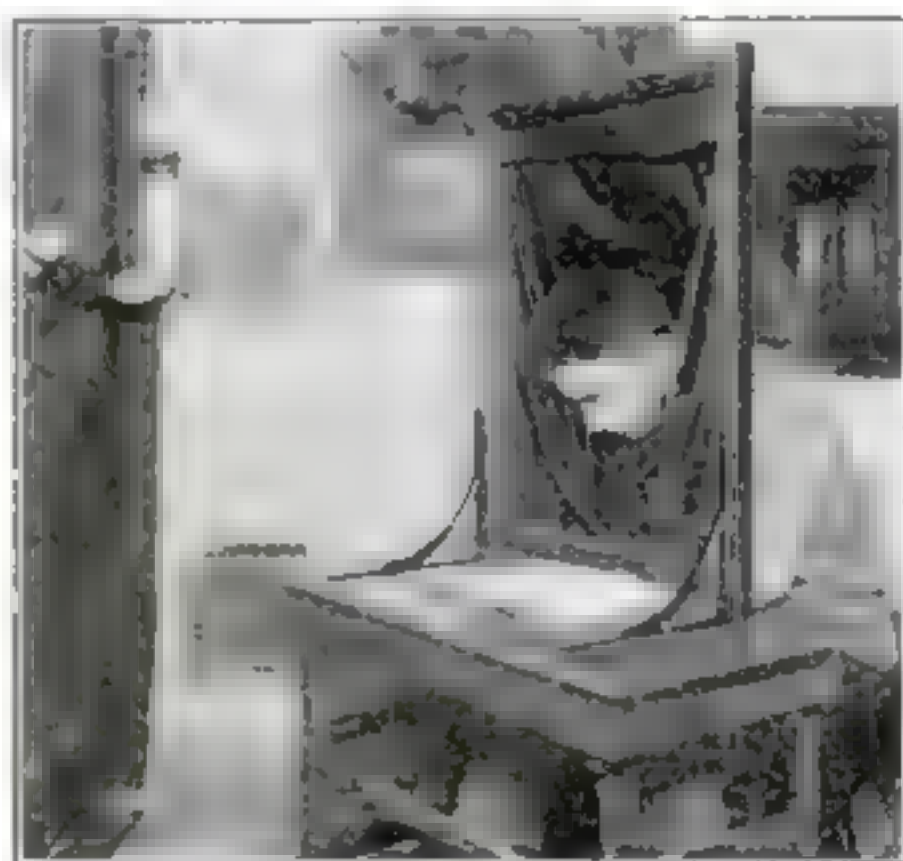
in the winter. Our clothing becomes damp on absorbing this moisture from the skin. Now, when a current of air passes over a damp cloth it takes moisture away from the cloth—or causes water to evaporate from the cloth. Heat is used up in

converting water or moisture into water vapor. Place a damp cloth on the bulb of an ordinary thermometer—the cloth need not be cold—and expose this to a breeze. You will observe that the thermometer immediately indicates a lower temperature.

This is just what happens to the body. When a breeze—even though it be a hot breeze blows across damp skin or damp clothes it extracts heat. The body is exposed more frequently to breezes in the summer; for we are out of doors more and even when indoors we have the windows wide open. This outdoor air is only very slightly purer chemically than the cool indoor air of winter. It is the *cooling effect*—not, however, cool enough to be chilling—which constitutes refreshment. The ventilating engineer has got to know the causes of "freshness"



This man's body is exposed to the temperature of one room and his head to that of another. He is breathing the air from the first room. The temperature of his head is being taken with an attached thermometer. The experiment determines exactly which part of the body is most affected by changes of temperature



Determining whether a student can do better mental work in a cool or a warm room

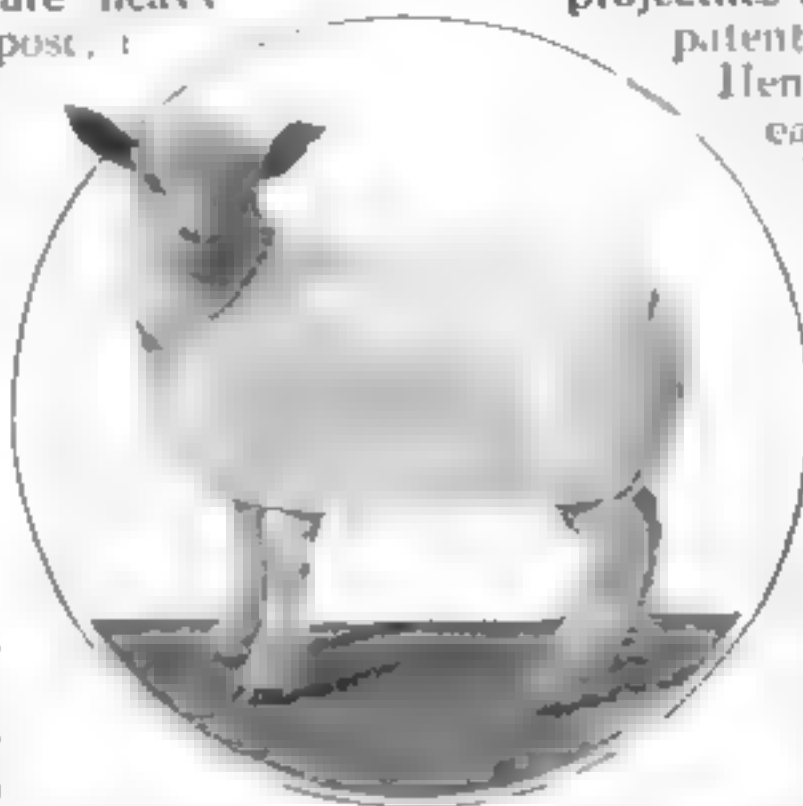
What a Life of Captivity Does to the Lion

SOME interesting facts have been revealed from a study showing the differences between wild-killed lions and those which had died in the National Zoological Park in Washington. It was found that captivity changes the normal buff color of the lion to a darker color, the color deepening for each successive moult for five years at least. Lions captured young and reared in captivity had muscles little developed, and as a result their skulls showed a marked difference from those of wild-killed lions. This was due, say the investigators, to the fact that the skulls of lions are greatly influenced by muscular activity. Using muscles develops them; and disuse destroys.

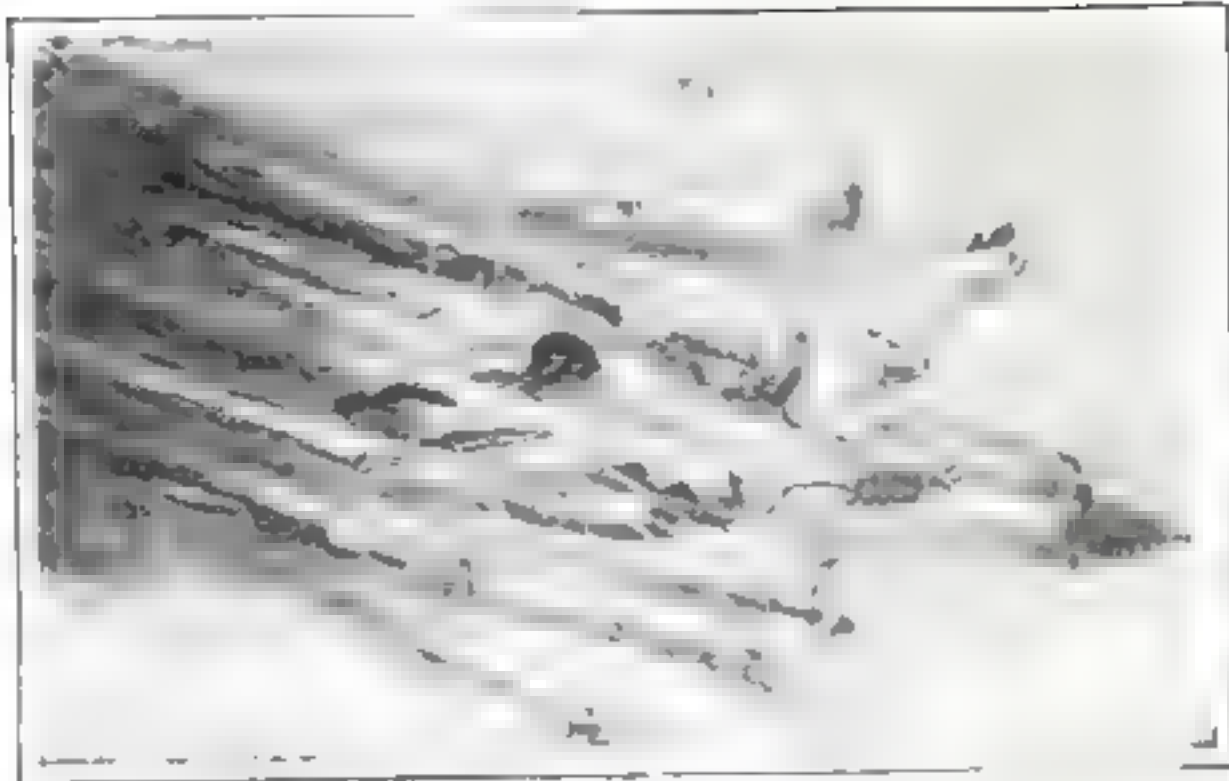
A Stylish New Blanket-Coat for the Baby Lamb

THE greatest obstacle which stands in the way of providing very young or new-born lambs with artificial coats or blankets to protect them from sudden changes in temperature or from storms until their own coats are heavy enough to serve the purpose, is the fact that the covering material is likely to destroy the lamb odor by which the mother recognizes her offspring.

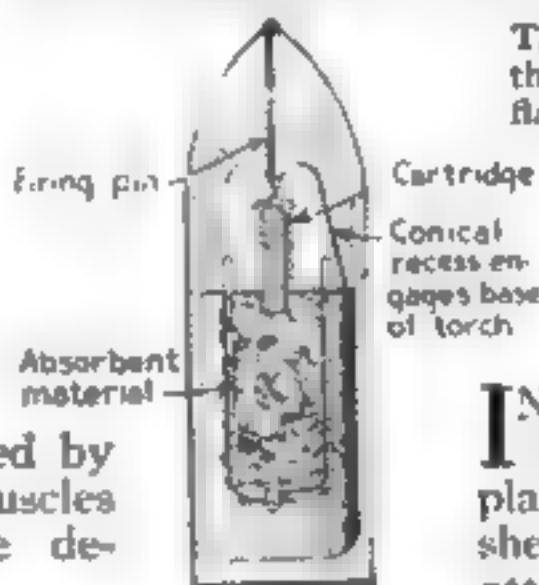
The blanket shown in the illustration leaves enough of the lamb's neck and body exposed to satisfy the mother as to the lamb's identity, and at the same time covers the vital portions of the body snugly. It is composed of a waterproof outer canvas, with a soft woolen lining. Four elastic loops fasten it on.



The blanket is made of waterproof outer canvas lined with soft woolen material



The centrifugal force generated by the rotation of the shell spreads the flaming gasoline in all directions



Firing Shells Charged with Gasoline Which Ignites on Impact

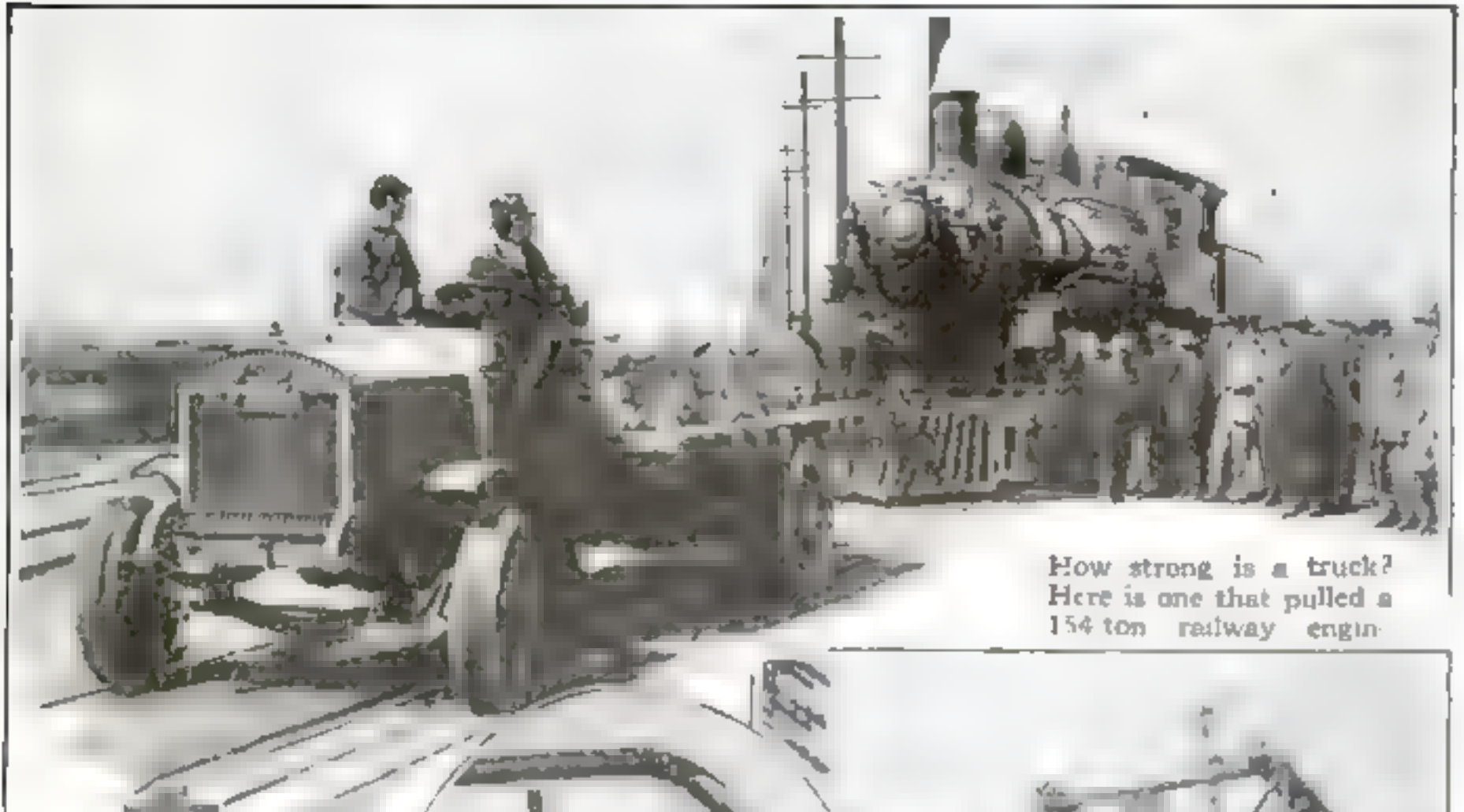
IN their great attack upon Messines Ridge, the British brought into play a new weapon, the inflammable shell. "We didn't use gas in the attack," said one correspondent, "but every known form of offensive

weapon I think we did supply, including a new horror known in the army as 'oil cans,' or 'boiling oil.' These on concussion burst and scattered conflagration over a wide area. We know from the prisoners taken that they caused terror and did an immense amount of harm."

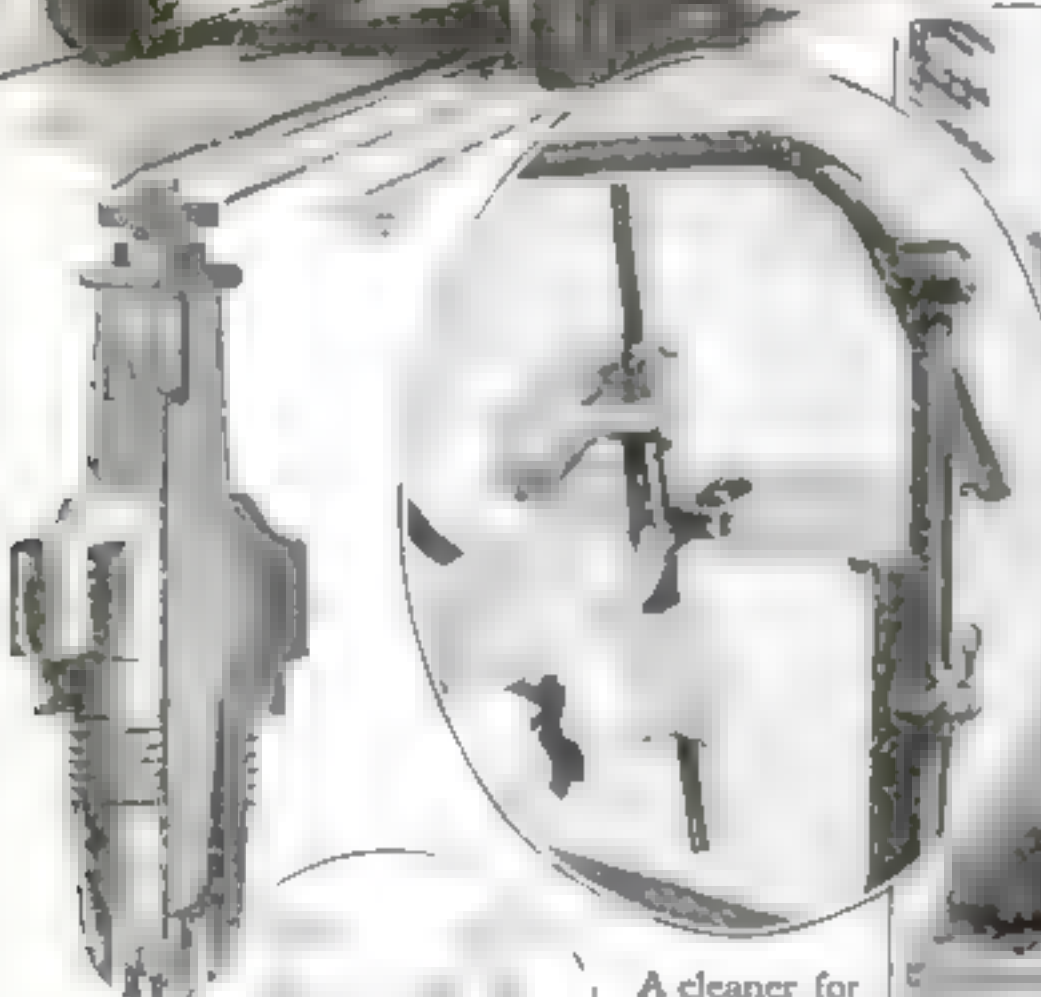
Light on the nature of these flaming projectiles is given by an American

patent which was issued to Henry Dean, of Michigan, early in the war. A chamber containing high-explosive powder is situated in back of the solid nose of the shell and right in front of the firing torch. Surrounding this highly-inflammable torch is the charge of gasoline which takes up by far the greatest portion of the interior of the projectile. Thus, when the nose of the shell strikes against the trench wall, the concussion sets off the gunpowder.

New Jobs for the Motor-Truck and New



How strong is a truck?
Here is one that pulled a
154 ton railway engine



The moving
ball in this
spark plug
prevents ac-
cumulation
of carbon



A cleaner for
the wind
shield whic
cleans both
the top and
bottom glass

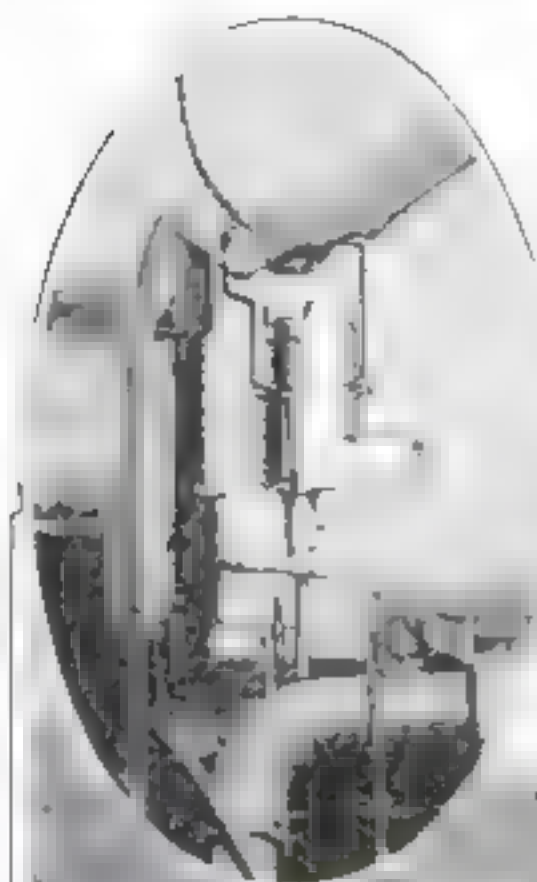


An old wood elevator and its frame-
work serves as an improvised garage



Even on a wet, slippery street, this four-wheel motor-truck was able to pull a disabled twenty-five-ton trolley car up a hill with a twenty per cent grade. The passengers preferred to walk

Additions to the List of Accessories

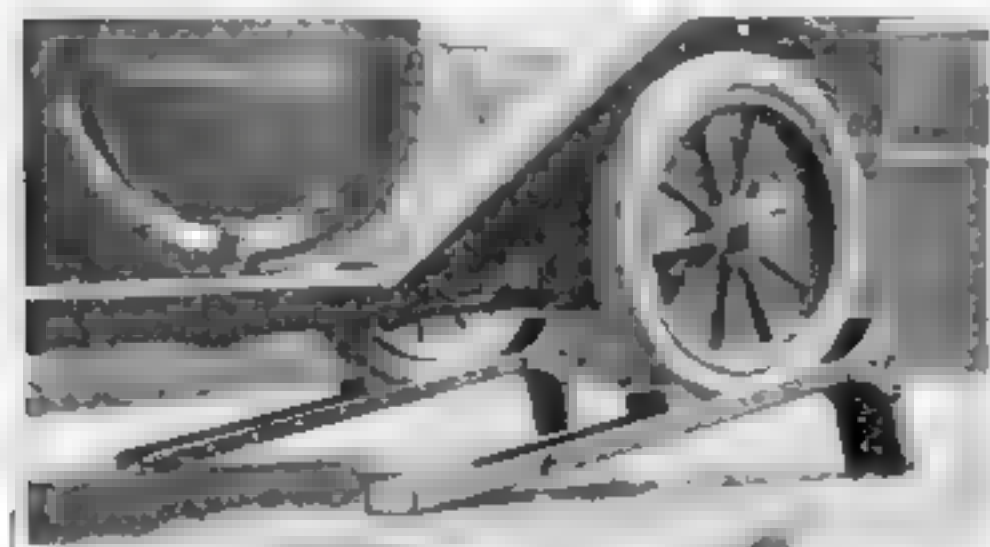


At left: A portable electric valve grinder fitted with a motor-driven drill tool

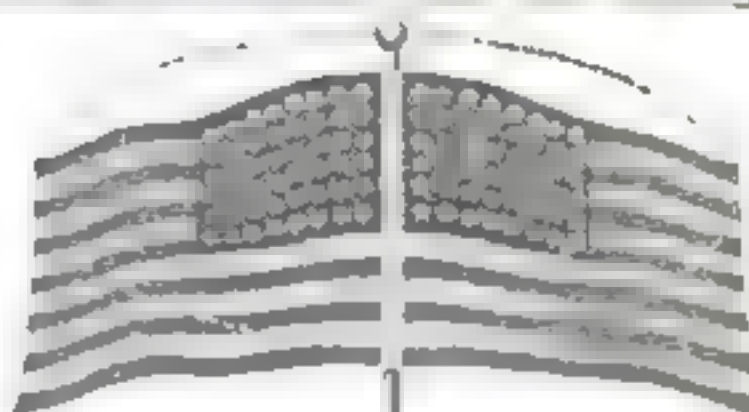
Attached to the radiator cap, this small fan revolved by the wind keeps the water cool



An automobile railway in Porto Rico. Flanged wheels take the place of tires



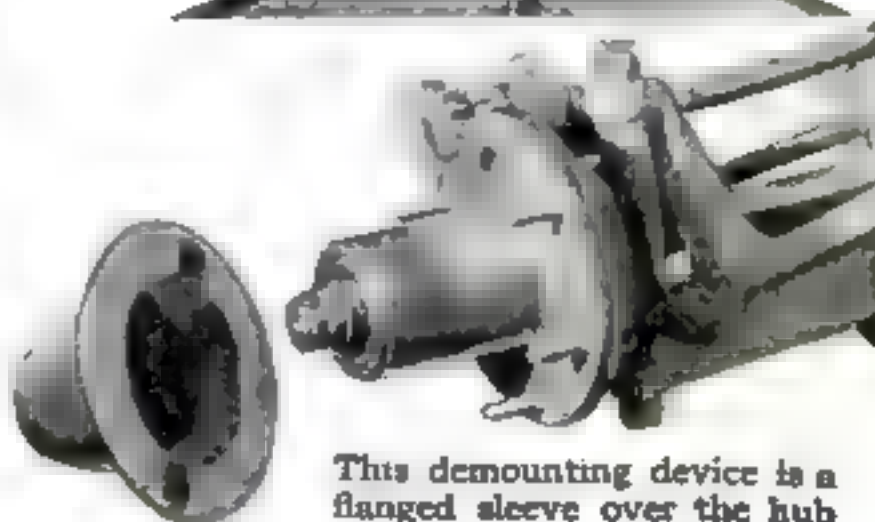
At left: Steel skids to elevate an automobile, supplant the repair pit



Flags which spin around like a pin wheel are mounted on the radiator



An automobile glove with "wings" to take in coat sleeve and keep it clean

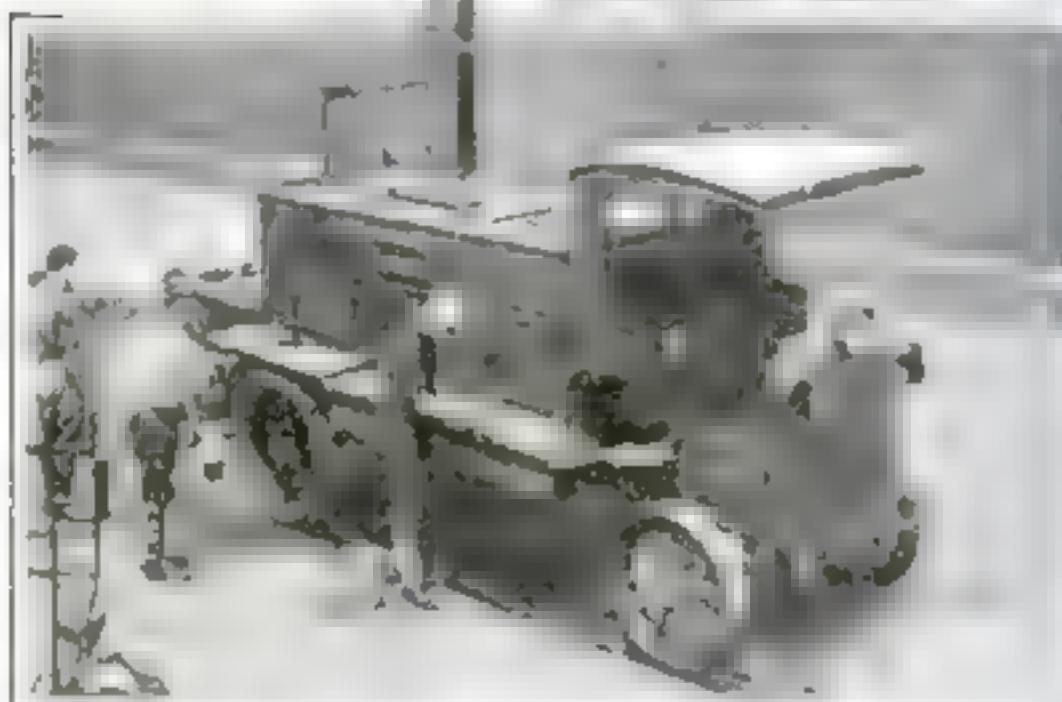


This demounting device is a flanged sleeve over the hub

War Work for Motor-Trucks



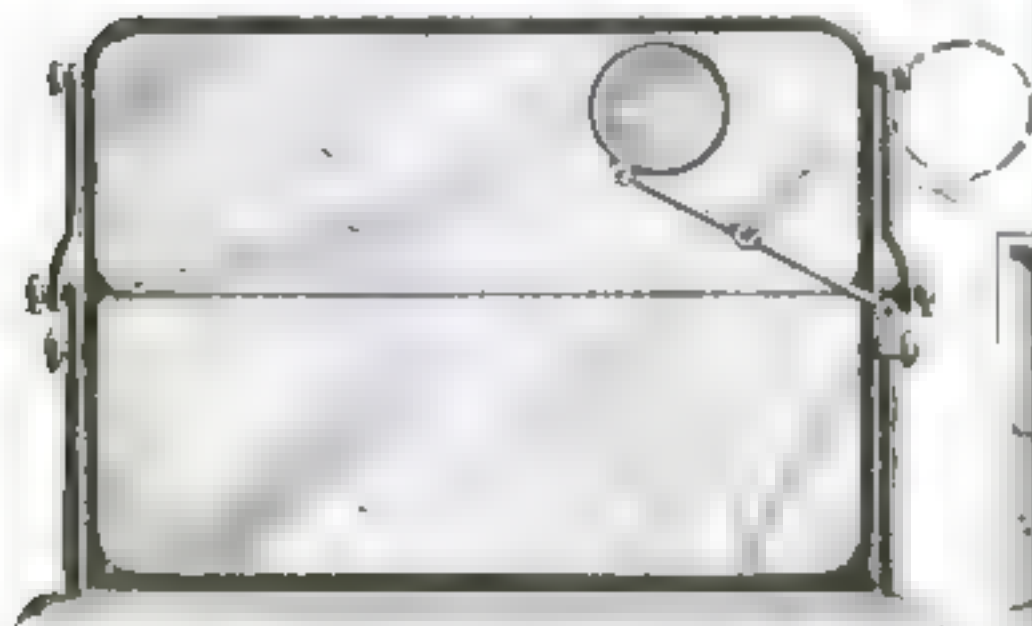
A motor ambulance which carries four stretchers, a first aid cabinet and a reserve supply of medicine



The army kitchen motorized. It was presented to New York National Guardsmen

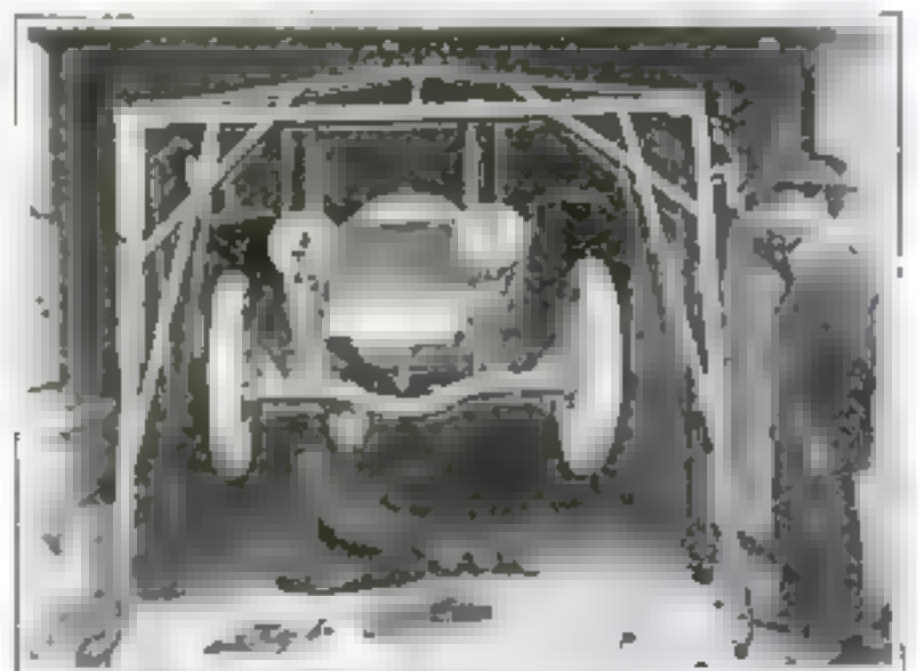


Utilizing the hollow space in the center of stored tires for a tool chest



Above: A wind shield glare dimmer which consists of a circular piece of colored glass

Below: The heat of this vulcanizer is furnished by a combustible disk in a metal container



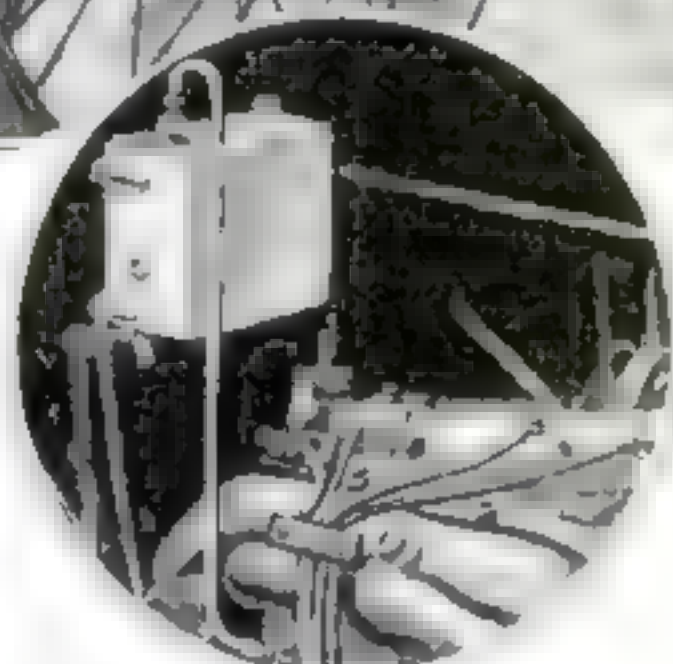
This motorized automobile derrick which is made of light metal will lift three tons

New Tools for the Automobile Repairman

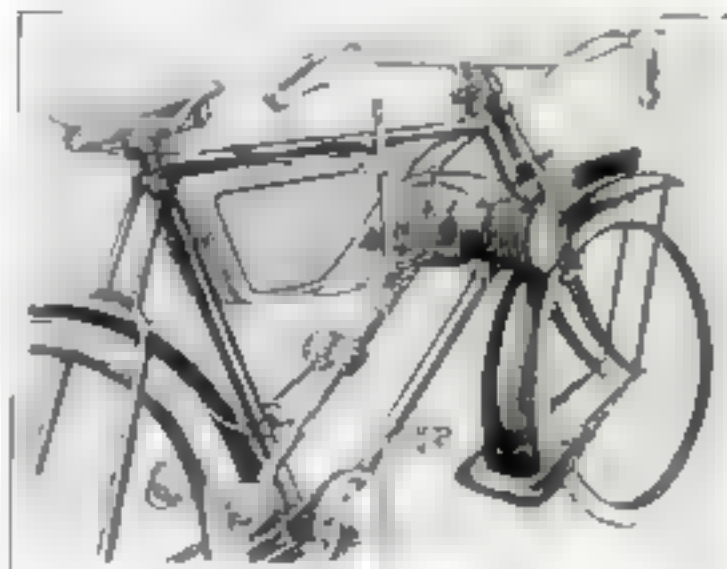
Doing a locomotive's work. The automobile pulls two freight cars with loads of from two to twelve tons



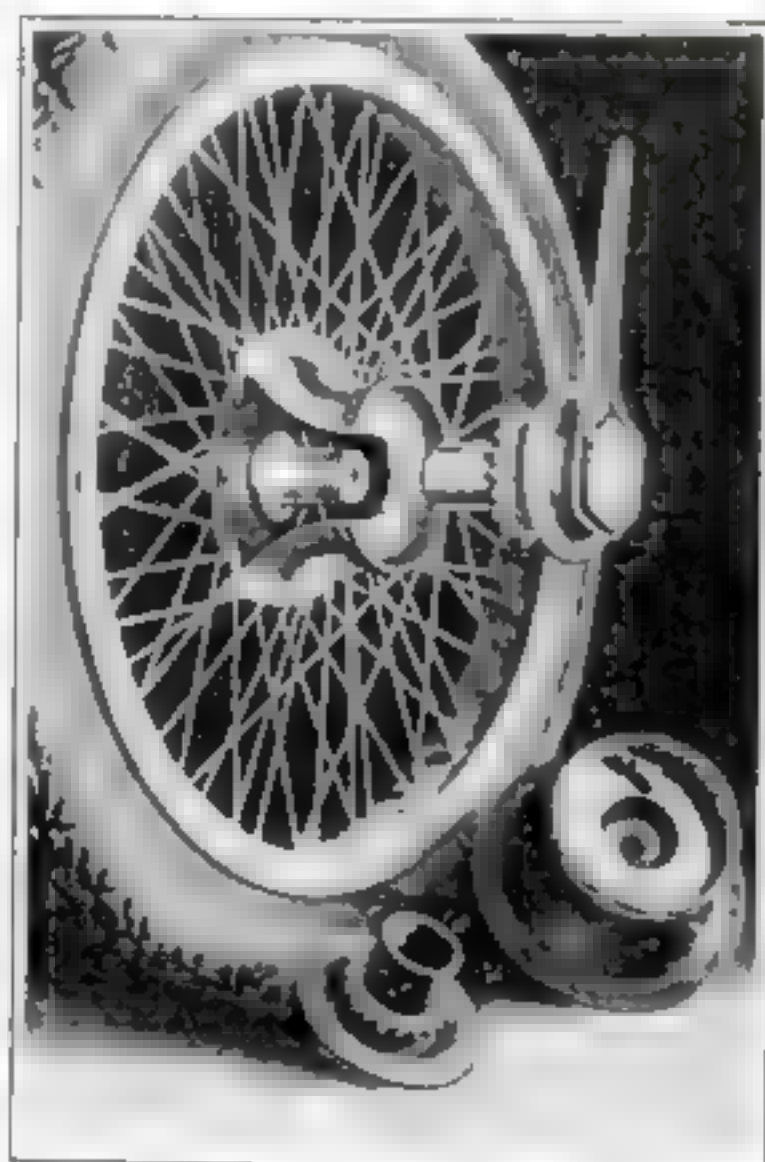
At left:
A new
cork insert
Ford fan belt
At right: Motor-
cycle padlock
locks the rear
driving sprocket
to the car frame



A new gas saver increases the
speed of the car and prevents
the formation of carbon



The latest oddity in motorcycles—
the motor is located in front, and
direct drive is obtained by friction



The method of driving a new wire
wheel is by means of six powerful drive
studs on inner drive flange of hub

A trouble
light with
a flexible
handle for
carrying it
into the
hard-to-
reach places

Turning a Car in Its Own Length

It is a mere matter of lifting it and swinging it around on its rear wheels

THE parking problem would be partially solved by the adoption of the device illustrated, which enables a car to turn around in its own length.

It consists of a small wheel carried crosswise of the car between the front of the motor and the radiator. This wheel is mounted on two pistons which may be forced down in vertical cylinders by means of a fluid under pressure from the engine cylinders until it contacts with the ground. A further downward movement of the pistons raises the front wheels of the car clear off the ground.

The operation of lifting and turning a car is controlled from a lever mounted in a small case in the driver's cab. One double-ended pipe is screwed into the combustion chambers of two of the engine cylinders and then led to a double piston valve in the control case. This piping serves to carry a small amount of the compressed cylinder gases to the piston-valve, by the manipulation of which the oil in the two vertical cylinders carrying the small lifting wheel on their piston rods is put under pressure. Check valves are placed in the line outside of each cylinder so that the oil cannot back up into the engine on the suction strokes.

The control cylinder in which the double piston valve reciprocates is normally open to the atmosphere so that the gas under pressure from the cylinders may escape when the device is not in operation. A backward movement of the control lever shuts off the opening to the atmosphere and

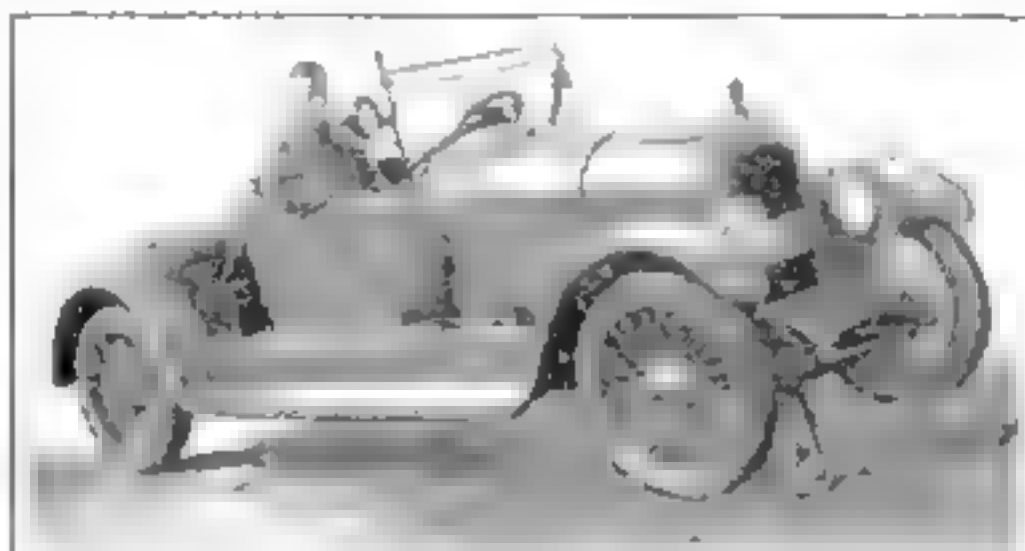
permits the gas to force the oil in the system through a pipe leading to the tops of the two vertical cylinders carrying the lifting wheel. A further movement of the lever to the right or left opens two valves into two additional pipes leading to the bottoms of the cylinders.

When the pistons have moved down to their extreme bottom positions and the front wheels of the car are lifted clear, the ends of the pipes leading to the bottom of left or right cylinder, according to the way the lever is moved, come op-

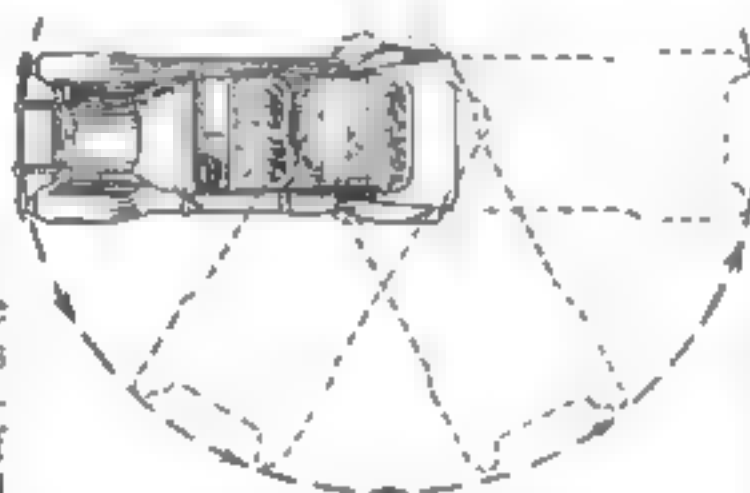
posite ports in the hollow piston rods and permit the oil to flow down into the pump on the wheel and turn it one way or the other through gearing.

The fluid under pressure escapes down the hollow piston rods to the gear pump integral with the small wheel, so that the small wheel is revolved to right or left. In this way the car is turned completely round, end for end,

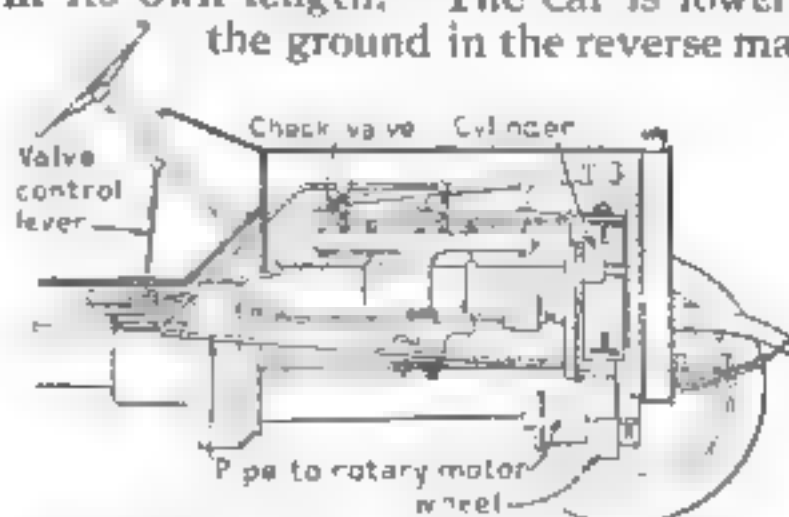
in its own length. The car is lowered to the ground in the reverse manner.



The small wheel carried crosswise of the car between the front of the motor and the radiator is mounted on two pistons by which the front wheels are raised



With the rear wheels as an axis, the car can be turned completely around in a space equal to its own length

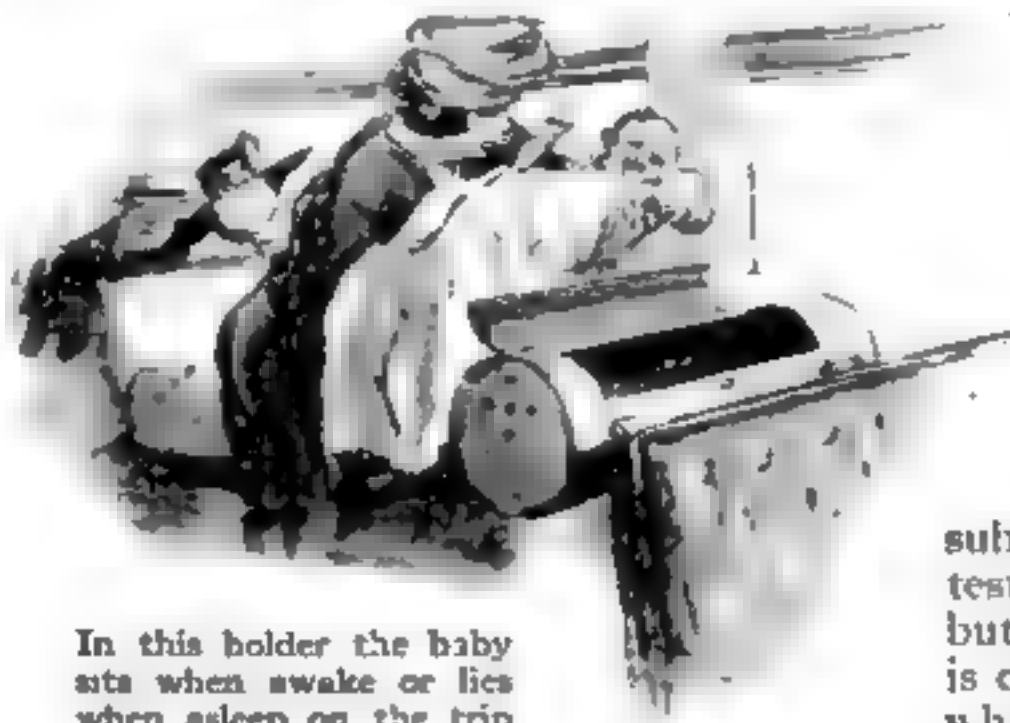


The lifting and turning operation is controlled from a single lever mounted in a small case in the driver's cab

Can the Baby When You Take a Journey

THE good news is true. We have been hoping for years that some intelligent inventor would come along with a device to can obstreperous infants during the late hours of the night. We suggested a hermetically-sealed can wrapped in sound-proof material, but Caleb M. Prather, of Evanston, Illinois, who is the inventor of the can illustrated, sidestepped our instructions at several important points.

He intends to use the can to rock babies to sleep. It is, in fact, a baby holder. Our can was to be a baby holder and silencer combined. Mr. Prather has provided several holes in his can through which air can reach the baby. We don't object to the baby getting air but as long as there are holes in the can the baby's yells will be as nerve-wracking as ever. That was our reason for the hermetically-sealed can. A cover of the can is fastened by a button, and a seat is provided upon which the baby can sit and suck his thumb when the top and cover have been removed. The can is of steel and it can be fastened to the rail of a porch, the back of a chair, or the seat of a railroad car. If the inventor will make his can air-tight and sound-proof—features which we originally suggested—we know of a bachelor who will buy a half dozen right away.



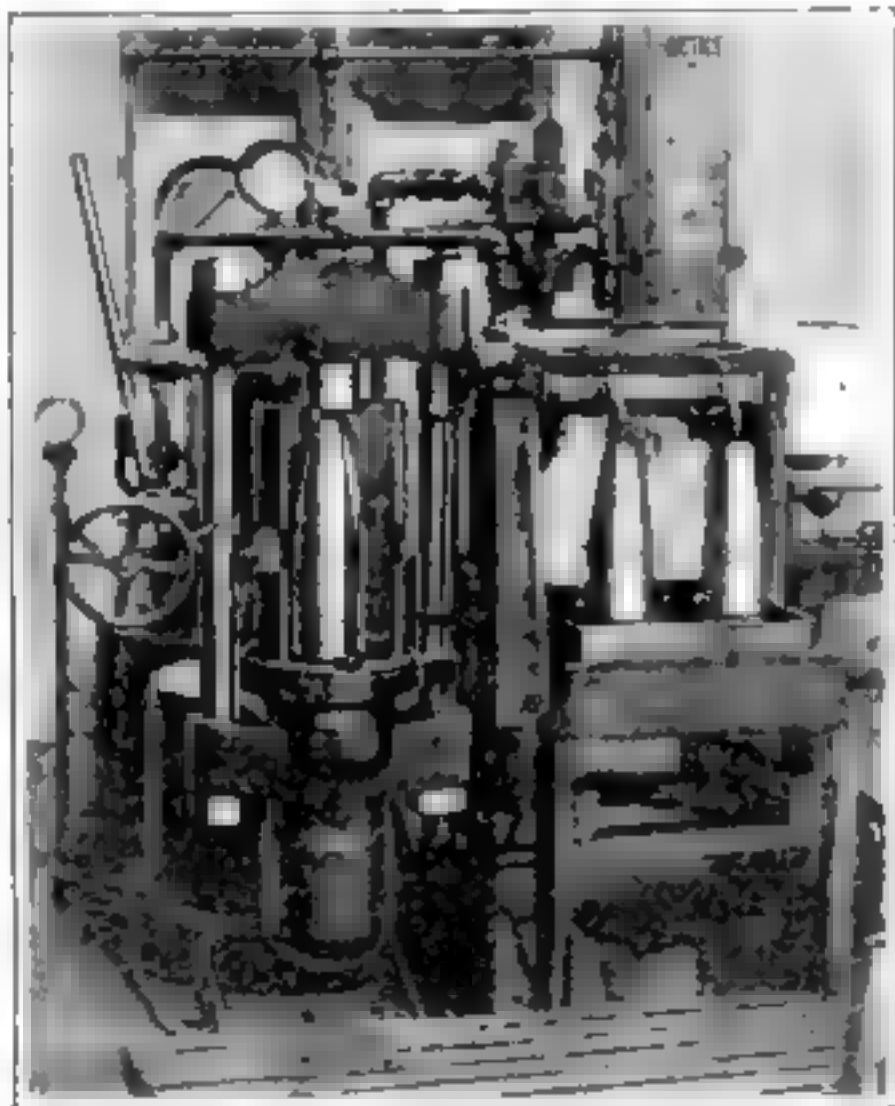
In this holder the baby sits when awake or lies when asleep on the trip

Will the Shell Burst When It Is Fired? A Water Test Tells

A PROJECTILE fired from a gun is subjected to enormous strains which it must be strong enough to withstand; otherwise it might be as dangerous to the gun crew as to the enemy. To assure safety as well as destructiveness, the steel from which the shells are made is subjected to different tests. Not only this but further examination is customarily made on what are known as test shells. Some of these

test shells are actually fired in the testing grounds; others are cut up and the pieces subjected to various strains which must be successfully resisted.

Since this can't be done to every shell, the shells used are picked at random, it being assumed that they typify the lot. The probabilities are that this would be so, but it is better to supply a simple pressure test required for some of the French shells.



Shells filled with water are subjected to a strong water pressure test for thirty seconds

This French pressure test consists simply of filling each shell with water and then subjecting it to a strong water pressure for about thirty seconds. If the shells are weak, they will either burst under the strain or a permanent expansion will take place. On the other hand, if the shells do not collapse and no permanent expansion takes place, the shells must be satisfactory so far as their strength is concerned. This is conclusive evidence which can be secured for each shell with little trouble.

From Soup to Nuts

"Who's who" behind the scenes in a big hotel or restaurant kitchen

ORDERING a meal at a fashionable restaurant or hotel is simple enough—to the diner. But it is safe to say that few have any idea of what goes on behind the scenes, that is, in the kitchens, after the order has been given to the waiter.

As a matter of fact, giving one's order of, say, oysters, soup, fish, steak, salad, dessert and coffee starts a most intricate process. In the first place, your waiter cannot give your entire order to one cook; he must go to as many different men as there are dishes on your order. First he stops at the oyster booth, where two or three men do nothing but open oysters. Then he goes to the soup cooks, of whom there may be six or eight; next, to the cooks who look after the fish, and so on to others who are specialists in the preparation of steaks, vegetables, salads, desserts and coffee. In the average large restaurant there are from seventy-five to one hundred and fifty cooks, all of whom, with the exception of girls who prepare the salads and vegetables, are men. In addition, there are the chef and his staff of assistants, who may number half a dozen and whose duties are to oversee the work of the others rather than to cook.

When your waiter has given your full order he returns to the oyster booth, gets your blue points and takes them to you. On his way out the oysters pass under the eyes of no less than five different checkers.

While you are eating your oysters, the waiter goes back after your soup, which must also receive the approval of the five checkers. The same process takes place in connection with each dish brought out, which means that your waiter, who seems so deliberate, does considerable



It only takes a word to order a dish, but it takes a whole organization to serve it. You may rave at the waiter for being slow but while he is out of your sight he is hustling from cook to cook with lightning speed

hustling during the serving of your meal.

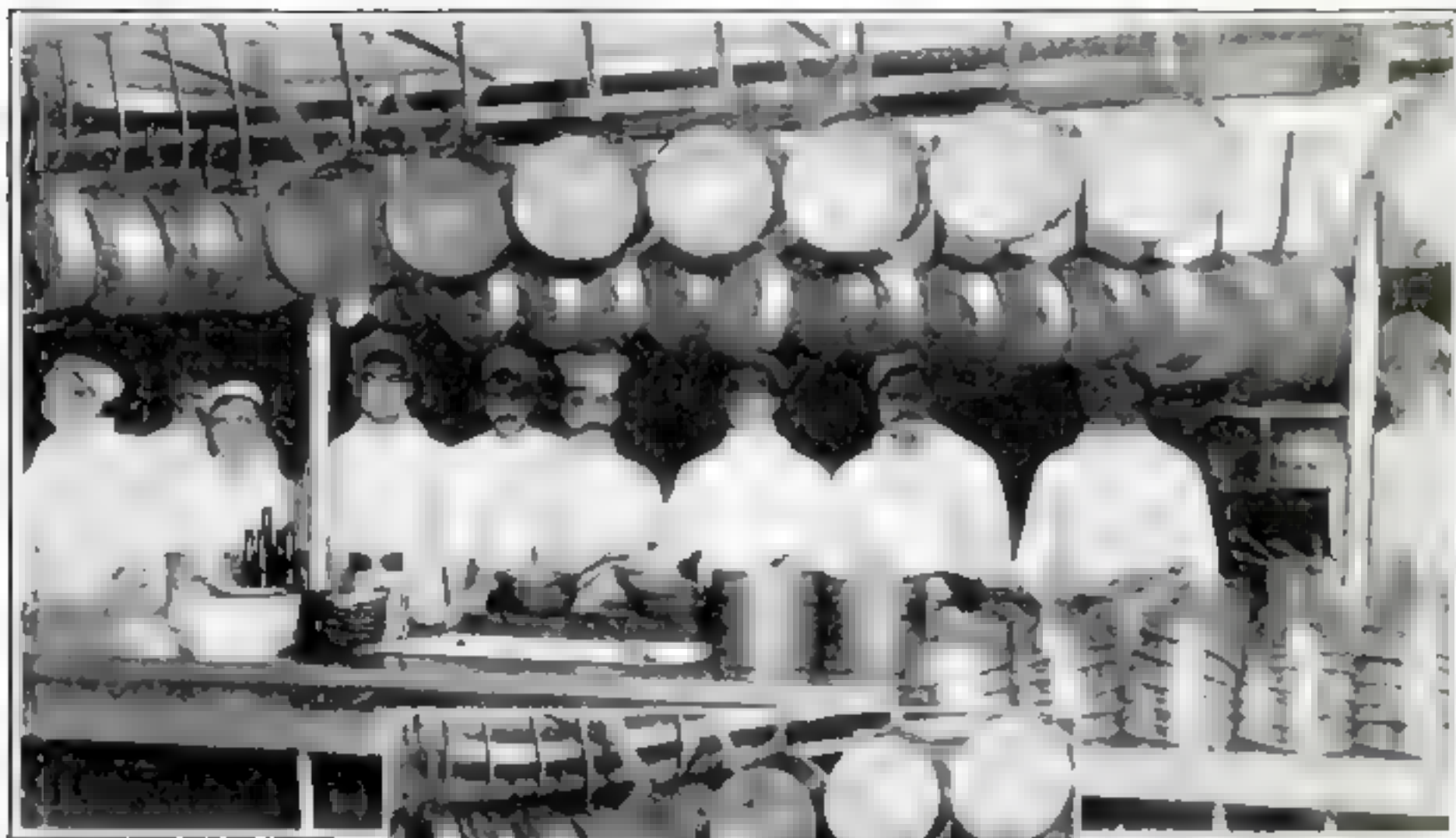
The huge range, from forty to sixty feet long, is given over to the frying of different kinds of food. It also contains the ovens; the broilers are separate.

The steward is an important personage in any large restaurant, and commands a large salary. He must not only know what people like to eat, but he must have

statistics to show about how many people will order each item on the bill of fare. The preparation of a bill, important as it is, by no means constitutes the steward's chief difficulty. He must know at all times exactly what the pantries and refrigerators and storerooms contain, and in ordering food from the markets, he must be



Checking up the food on his tray. The waiter has to pay for each item in chips out of his own pocket



A battery of cooks surrounded by pots, pans, covers, and skillets which are all used during the busy rush hours

At right: A special order for a guest known to be hard to please. The head chef is there to cast his critical eye over it



sure that he has enough of everything to fill all probable orders, and yet not so much that it will be wasted.

He doesn't have to guess at how many people will order this or that dish so much as might be imagined. He has a book in which are pasted menus of many other days. On these he has marked the number of

people that ordered a certain dish when it was offered before. Consequently he is able to judge very closely how much should be prepared the next time. If by any chance there is a larger call for the dish than on the last occasion, the steward, who watches everything going on in the kitchens, notes this, so that by the time the supply begins to run out, he is having extra orders of the dish prepared. That is why a restaurant of the better class is "never out of" anything.

And it is to pay the salary of all these that your five-dollar bill goes, as well as to meet the cost of provisions.



There are from seventy-five to one hundred cooks in the average restaurant. All are men. But girls prepare the salads and vegetables

Both desk and chair are mounted on stools. The relation of the hands to the keys remains the same whether the operator stands or sits at her work



Work the Typewriter Standing and Sitting—It Lessens Fatigue

THERE is no waste of any kind in the world," says Frank B. Gilbreth, the motion study expert, "that equals the waste from needless, ill-directed and ineffective motions." One result of this waste is fatigue. Some fatigue is necessary and some unnecessary. It is the business of the efficiency engineer to eliminate all unnecessary fatigue and to distribute the necessary fatigue properly.

As the result of his study of fatigue, Mr. Gilbreth has come to the conclusion that few work benches or tables are absolutely satisfactory that do not permit the worker to work equally well standing or sitting. The worker

should be measured for the chair in which he spends one-half of the time that he is awake during his entire working life.

If the worker can perform his task standing as well as sitting, his implements and his work should be so positioned that he can relieve his tense muscles by discarding his chair.

Take the two accompanying photographs as an example of what Mr. Gilbreth has done for the typist. Note that both the typewriter desk and the chair are mounted upon stools. The relation of the hands to the keyboard remains the same whether the typist stands or sits. When she is tired of sitting, she has only to push aside the chair and stool and to continue her work standing.

Here we have an example of the proper distribution of necessary fatigue so that the efficiency of the worker is increased and her well-being improved.

Each Salesman Has His Own Telephone in This Grocery

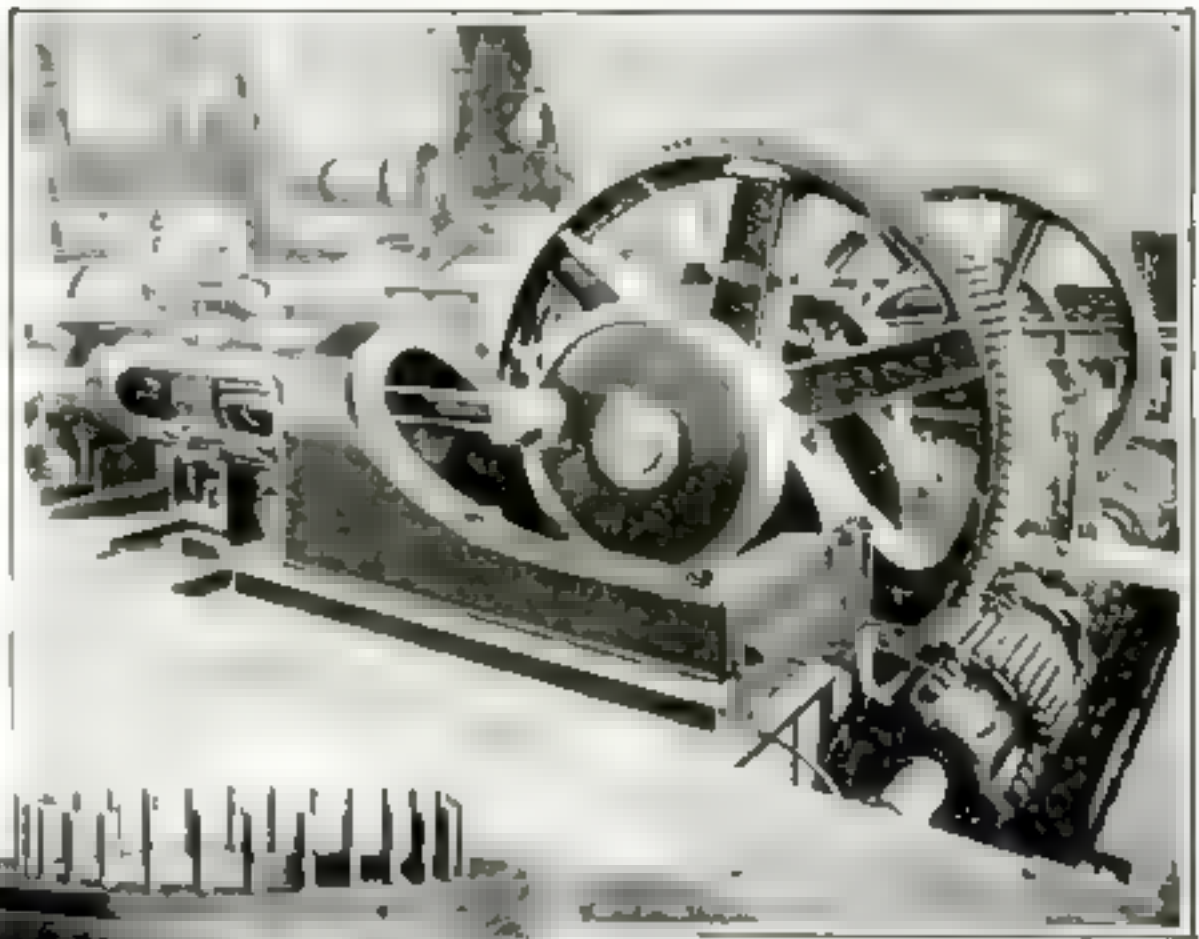
A CHICAGO grocer increases his business through telephone orders by supplying each of his salesmen with a special telephone on a table bearing the salesman's name. Thus he avoids the delays and confusion entailed by calling the different salesmen to the telephone.



Each salesman has his own telephone and samples of the day's "specials" before him on his desk so that there is no delay

Buttons Are Now Made as a By-Product of Beer

THE spent yeast which collects in breweries and distilleries is put through a process which turns it out in the form of buttons, door-bell plates and knife handles. Formerly this left-over material was considered to be a bothersome waste; now it is utilized, every bit of it. As it is gathered from the vats the yeast is of a dirty, gray-brown color. The first operation is to dye it and then to work it over until it assumes the form of powder and can be hot-pressed into any form. In this stage it is called "ernolith." It may be sawed, scraped, filed, drilled, engraved, turned to an edge, and polished. The material has a particularly close and fine structure, and possesses sufficient hardness and elasticity for all ordinary purposes.



Where the rigid teeth of a steel gear would scrape together those of the gears made from cotton yield



A hydraulic pressure of from six to eight thousand tons is required to make the fiber gears

This Truck Loader Will Lift One Ton Ten Inches Per Second

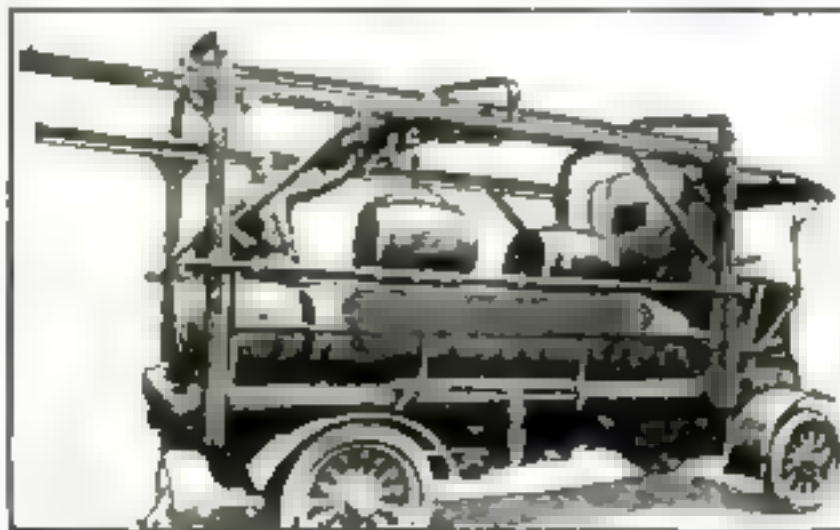
MECCHANICAL loading devices are not rare, but the one shown in the illustration below has several novel features. It is in three parts: a supporting frame, a traveling crane and a dynamo for generating the necessary electricity. The traveling crane comprises a motor, a clutch, a driving mechanism and a lifting winch. The hoist is carried on a transverse track which is part of the traveling crane, so that it can lift a load from any point across the width of the machine. It can be locked in any position desired. The winch has a capacity lift of one ton at the rate of ten inches per second. E. Fourhee, of Paris, is the inventor

Gear Wheels Made of Cotton. They Outlast Steel Gears

GEARS are now being made of ordinary cotton which outwear those made from the finest steel. It seems incredible, but it is true.

The very hardness of the metal gears causes the teeth surfaces to scrape over each other when they mesh, producing hideous screeches and groans. Every one of these scrapings means a certain amount of wear.

Teeth made out of compressed cotton yield. They are therefore perfectly noiseless. Compared with the metal gears, they are indestructible. To make these fiber gears, a large cylinder built up of cotton disks is compressed to but one sixteenth of its former length!



A brewer's wagon supplied with a traveling hoisting crane, which is electrically driven by a dynamo under the floor

The New American Enfield Rifle

A modification of the English Enfield
with which our troops will be supplied

IN order to obtain a sufficient number of rifles with which to arm the new United States army in as short a time as possible, the War Department has decided to supplement its supply of Springfields with a modification of the English Enfield rifle which is being manufactured in this country in large quantities for the British government.

When plans for the army to be formed under the provisions of the draft law were being worked out, it was realized that the facilities which the Government had at hand for making the 30-caliber Springfield rifles were not adequate to turn out the number of rifles needed and that to build factories capable of supplying this number would mean a delay of many months.

Three big arms concerns were then making about 2,200 Enfield rifles a day for the British Government and they were in a position to increase even this output. Hence the decision to manufacture a modification of the English Enfield adapted to the standard 30-caliber ammunition of the United States rifle. Within a few months these concerns will be making more than 5,000 of the new rifles a day for the United States Government according to present estimates.

The operating mechanism of the new rifle, while differing in general design, has the same functioning features as the Springfield; that is to say, operation of magazine, loading and extracting, rotating motion of bolt and side ejection. The barrel is made of the same specifications as the Springfield with the exception that it is two inches longer than that of the Springfield, which measures 23.79 inches.

The weight of the Springfield with bayonet attached is 9.69 pounds; the new Enfield model weighs about three-quarters of a pound more. The bayonet of the new arm is 1.125 inches longer than that of the Springfield, which is 16 inches long; the assembled rifle with bayonet attached is 4.125 inches longer than the Springfield, which measures 59.212 inches from the butt plate to the point of the bayonet.

The design of the bayonet of the new rifle is practically the same as that of the Springfield bayonet, the only difference being that in the new rifle the back or top edge of the blade is straight along its entire length and the front or lower edge tapers to a point.

The magazine is practically a duplicate of the Springfield, permitting the use of the same cartridge clip carrying five cartridges. In the Springfield the rear sight is on the top of the breach end of the barrel whereas in the new Enfield it is on the top rear end of the receiver.



That Bit of Butter Left on Your Plate —What Becomes of It?

THERE are about sixty-four individual helpings of butter in a pound, each helping equaling about one fourth of an ounce. If the accumulated "scrapings" from the butter-plates after the meal were estimated there would probably be about one "pat" collected each day, in the average household.

But if every one of our 20,000,000 households should waste one fourth of an ounce of butter daily, it would mean 312,500 pounds a day, or 114,062,500 pounds a year. To make this butter would require the product of over half a million cows. Even if such a waste occurred in only one home out of one hundred, the waste would still average over a million pounds—which is intolerable to think of, when the value of butter is so great intrinsically and gastronomically, and when those bits of butter might be put to such good usage if collected in a crock by the cook.

This Vacuum Cleaner Is Used Like an Ordinary Broom

A NEW vacuum cleaner which operates without electricity combines the features of a carpet-sweeper and ordinary broom with the special vacuum feature. A bellows, which is operated by the backward and forward motion of the cleaner, furnishes suction which draws the dirt and dust up into the retaining bag.

Revolving brushes in the central portion of the cleaner and a row of stiff bristles around the border serve to stir up the dust and loosen its hold on the threads of the carpet. As the particles are dislodged by the bristles, the brushes sweep them under the mouth of the suction tube and the bellows pressure sucks them up into the vacuum. In this way every particle of dirt is removed.

The work is thorough and is accomplished with little effort. The cost of the cleaner is low and the operation is as little complicated as that of the ordinary broom. The brushes may be used alone.



The vacuum-broom, which sweeps the carpet and then takes up the dirt by suction



Shipping butter in crates in which an ice container is inclosed for refrigeration

How Print Butter Is Shipped to the Retailer

THE wholesaler who sends his butter out to the retail trade in neatly wrapped pound-packages or "prints," runs less risk of having his product spoiled in transit than if the butter were shipped in tubs. The accompanying photograph shows how he manages to keep the butter fresh and in shape until it is delivered. Into each packing box a closely covered tin filled with ice is placed. Around this the prints of butter are packed. Then the cover of the packing box is nailed on. The cold air is thus confined inside the box. The ice melts very slowly, so that the butter is kept firm and hard for many hours.

Even when there are long delays in transit so that days instead of hours are consumed, as sometimes happens, the butter remains hard and firm; for if the ice should finally melt, the water in the tin would still remain almost ice-cold.



© Newman Traveler and Benson and Dawson

Every bit of wood in the little house has its story or legend. The images are the figureheads taken from the bows of vessels. They are very lifelike and peer uncannily from unexpected places

The Graveyard of Ships that Passed in the Night

MONNSANTO is the name of a man remarkable not only in character but in occupation. His home is the Island of St. Thomas, recently bought from Denmark by the United States. A visitor to St. Thomas cannot fail to hear about him, and should not miss the opportunity of seeing him.

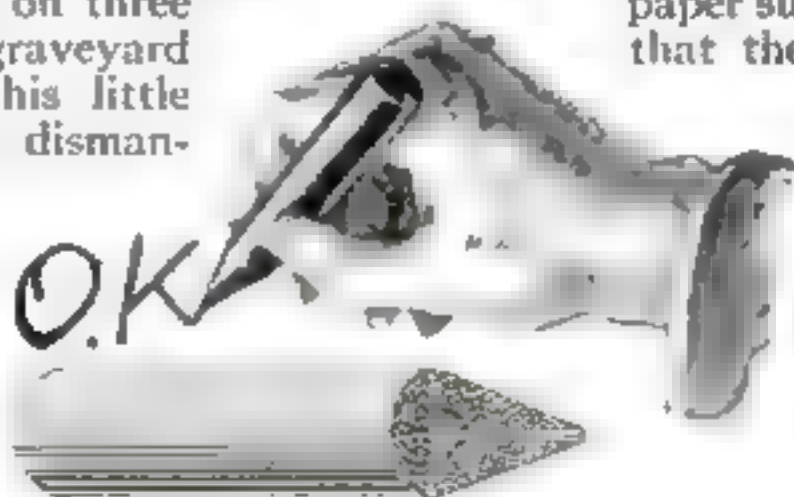
He lives on Krum Bay, a crooked arm of the blue Caribbean, almost landlocked by the hills that surround it on three sides. It has been the graveyard of many a ship. In this little haven the vessels were dismantled; the shore-line is strewn with their remains. The home of Monnsanto is constructed entirely from the wood of these ships. Every beam and plank has its story or legend. Wood is wood and iron may be iron, but when it is put into the form of ships, it becomes a thing of life and each plank shares the ship's history.

What Is It—Pencil or Pen? It Has Neither Wood nor Graphite

A WRITING implement composed of a mixture of wax and finely-ground pumice stone containing particles of ink, has been invented by William C. Geer, of Akron, Ohio, to take the place of ordinary and fountain pens, pencils, crayons and all other writing implements. As the body of the new writing device is composed of a mixture of wax and pumice stone, which is easily worn away when rubbed against a paper surface, the inventor claims that the cells of ink intermixed

with the wax and pumice stone will also be liberated, giving a uniform supply of ink.

The device is made by mixing the wax, pumice stone and ink together. When it is heated to the proper temperature it is suddenly immersed in cold water. This chills and solidifies the wax mixture, producing a body having a cellular structure, each cell being filled with ink.



The cells of this pencil pen are filled with ink which is liberated as the wax interior melts

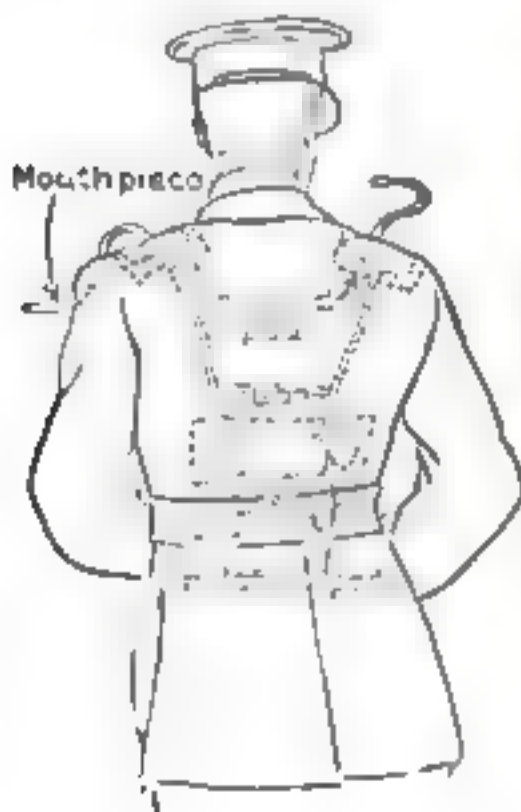
ture, producing a body having a cellular structure, each cell being filled with ink.

A Shock Absorber for the Soldier's Kit

NOT all the difficulty that a soldier has in carrying a pack on his back is due to the sheer weight of it. An equal, if not a greater strain is caused by the constant jolting of the equipment as he walks along.

To ease this strain, an Englishman, James A. Pugh, of Cardiff, Wales, has invented a pneumatic shock absorber for the soldier. The incessant jolts of the soldier's pack are cushioned on this, and the strain of marching is correspondingly lessened.

Two small pads of rubber are sewed in pockets at the shoulders of the man's tunic. Another similar, but larger pad is sewed in the back of the tunic, just above the belt. Corrugations on the under side of these pads allow the circulation of cool air, so that the soldier's back will not feel the heat of the pack. By inflating all three pads through the small connecting tubes and their check-valves, they are converted into veritable cushions which will take away all the shock of the heaviest pack. The pack is fastened on in the usual manner, and is then inflated through the mouthpiece shown in the photograph below. The two ends of the mouthpiece fasten together across the front when not in use. When unclaspd, the pads become deflated automatically.



© Newman Travelbelle and Brown and Dawson

A life-boat drill on board a coast liner. All on board must don life-preservers when a bell rings

The Life-Preserver Is More Important Than Meals Aboard Ship

THE life-preserver is your best friend when you travel on ocean liners these days. Even the captains of ships that steam along the coast insist that you get acquainted with the life-preserver the first hour or so you are on board.

Lifeboat drills are now regularly held on all liners. At the sound of a bell the passengers and as many of the crew as can get away from their posts, rush to positions on deck previously assigned to them. They immediately don their life-preservers and then wait for the next signal, which may direct them to get into the boats or order them back to their staterooms.

A certain number of passengers are assigned to each boat and an officer is appointed to take charge.

Sometimes drills are held every two hours during the day to acquaint the passengers thoroughly with their positions on deck and to get them used to the warning bell which usually sounds when least expected. The life-preservers are made of canvas-covered cork.



These air-filled cushions keep the back cool and protect it from jolts

Two Ties in One—The Bow and the Four-in-Hand

D. D. BAILEY, of Coffeyville, Kansas, has devised a method of saving his ties by combining his four-in-hands and bow ties in one tie. Thus he can wear the bow ties as four-in-hands, or the other way around.

His first efforts resulted in a folding tie, too bulky to be practical. Then he put one tie inside the other, making one serve as the padding of the other. That met all requirements. This method of combining the ties by means of clasps eliminates all padding in the four-in-hand, because the bow tie takes the place of the padding, and also eliminates all but the end of the four-in-hand itself. In the duo-tie there is little more material than in the regular four-in-hand. The under part of the tie does not show when worn, so that you could wear a green bow tie and a red end, if you wanted it that way or any other combination.



Tying a four-in-hand. When worn in this way the bow-tie portion is the padding

Your Motor Is Known by the Piston Rings It Has

HOW far and how fast your automobile travels, depends upon the power emanating from the motor, and that power, in turn, depends upon the piston rings. Piston rings are inserted because they increase the motor power of the car, keep the compression at maximum and therefore put more power behind the drive of the piston itself. A good piston ring will touch the cylinder walls at all points, making an air-tight joint.

With all joints air-tight the gasoline concentrates its entire energy on the top of the piston head when it explodes. It is like the charge of powder behind a bullet in a rifle. A poor piston ring, like an ill-fitting bullet, will lose much of its propulsive

power. Therefore, the piston rings are the soul of an automobile motor. The finest built motor with indifferent piston rings is an indifferent motor. Built to give a rated power, it loses that power if the piston rings do not conserve it.

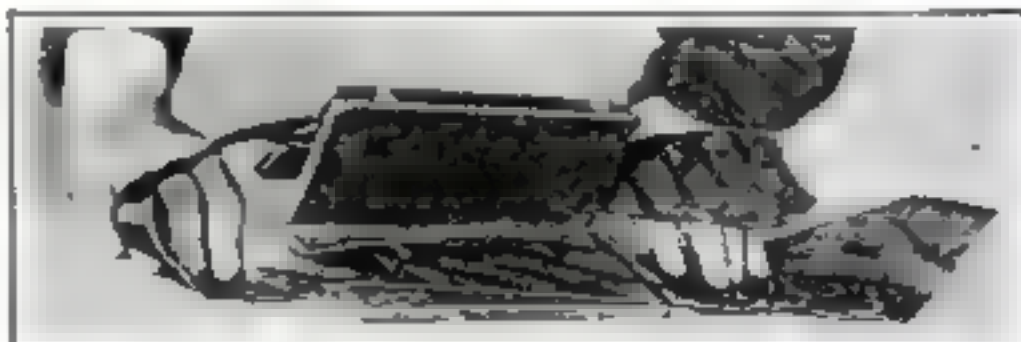
When you select a piston ring for a motor, it is best to get a ring that is made of one piece. Since the piston of a gasoline engine has to work in its cylinder millions of times, the fewer parts there are the better. As a rule, the piston ring should be made of durable cast iron or steel.

It Holds and Presses Your Tie at the Same Time

A COMBINED necktie holder and press which takes the wrinkles out of your scarfs after you have worn them is the latest convenience for the man who is particular about his neckwear. The holder and press is of veneered maple. It takes the wrinkles out of a scarf at the particular place where they have been caused, by stretching that portion under spring wire clamps.

The wide part of the tie is held in a press as well as the narrow part, strong wire springs holding the wooden members closely together. The holder may be hung on the wall, as a portion of the wire spring projects for that purpose. Several ties can be accommodated in the holder at one time.

Pressed in this way, the ties are kept smooth without the sheen imparted by a hot iron.



A holder that keeps your ties in shape by pressing them tightly between boards clamped together

A Crutch Built on the Principle of the Rocking Chair

A NEW crutch has made its appearance in England, where crutches just now are as numerous as walking sticks. Its principal feature is a rocker at the base, like that of a rocking chair. This is said to make walking easier. Instead of two sticks coming together to form a round stump the sticks of the new crutch are continued parallel from the shoulder-rest to the rocker.

The rest that fits under the armpit is a curved piece of hollow rubber tubing, like a motor-car tire, and the handle is adjustable to the height.



The crutch has a rocker like a rocking chair, which makes walking easier

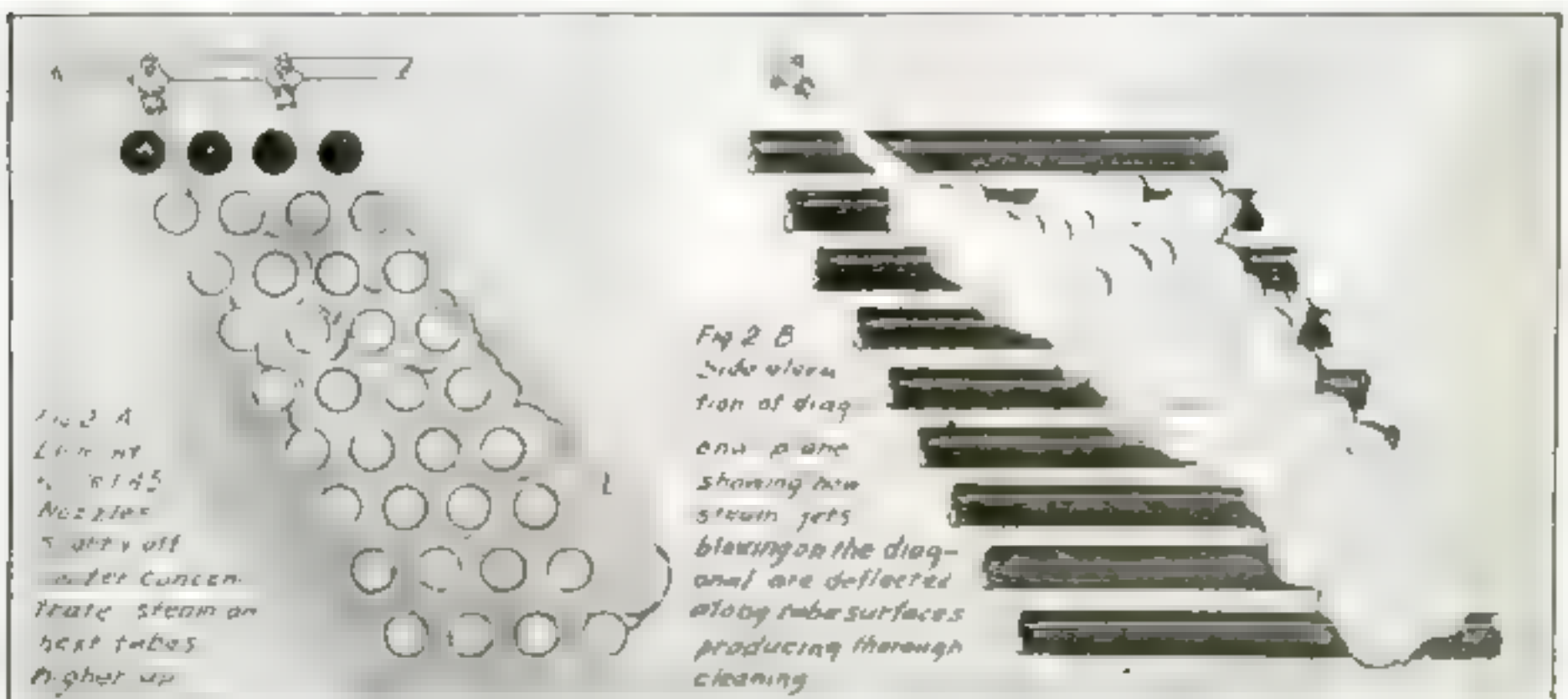
Steam Jets Which Save Thousands of Dollars in Large Power Plants

IN large power plants even little "losses," if allowed to continue, will produce an annual loss of thousands of dollars. Of all such losses, that caused by soot is one of the most persistent. Collecting as it does in layers perhaps an inch thick about the water tubes in the boilers, it serves to in-

sulate the water from the heat of the fires.

A method employed by a Chicago firm for doing away with the soot evil, first allows the soot to collect. Then, through rows of nozzles mounted at short intervals at the top of the water tubes, live steam is passed at high velocity. At first, the steam jets are directed downward on the lower rows of tubes. No speck of dust can hold its perch. By slowly rotating the nozzles, the turning jet is directed upon the middle rows of tubes, and lastly upon the very top ones. The battery of steam jets strike at an angle. The steam glances off, carrying the soot with it without wearing away the pipes.

At no point do the nozzles direct the steam directly upon the pipes. By blowing diagonally upon them the force exerted is used in carrying away the soot rather than in beating upon the pipes. In this way a boiler can be rendered one hundred per cent more efficient. Less coal or fuel will be required to get up a given amount of steam and the pipes and metal parts of the boiler will last longer.



Layers of soot on the water tubes of a boiler insulate the heat from the fires. Such a condition is avoided by blowing the soot off with high-velocity steam through sets of rotating nozzles

Nasty Job This—Cleaning Customers' Ears

EVIDENTLY the Japanese are a long-suffering people. Take for instance the docility of the occupant of the barber's chair in the accompanying photograph. He has seated himself there to get his hair trimmed and will pay the price, no doubt. But as part of the tonsorial operation, the barber, with a contrivance somewhat like a series of blunt knitting needles padded on the ends with cotton, proceeds to clean out the ears of his patron. The boy in the background illustrates the oriental's fear of the camera.

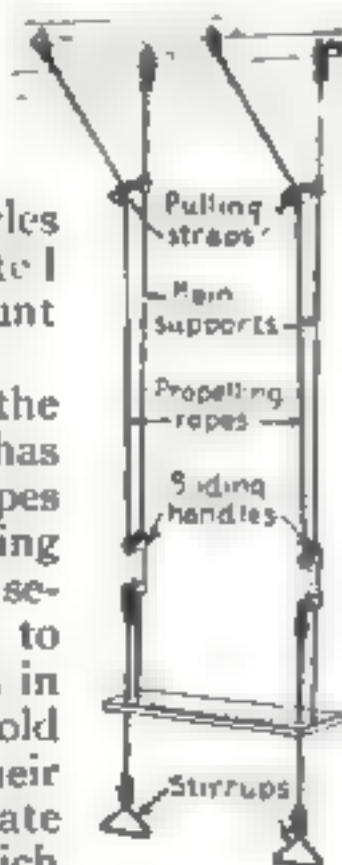


Cleaning out the patron's ears is an important part of the barber's duty in Japan

Pulling and Pushing to Make the Swing Go

BECAUSE it was impossible to read the evening newspaper and swing his children at the same time, George A. Netcott, of Independence, Iowa, set about to devise a self-operated swing which would enable a child to swing itself without calling on the parent for assistance. After developing three styles of swings he finally adopted the one illustrated on account of the ease of operation.

His swing differs from the ordinary swing in that it has an additional pair of ropes which serve as the propelling force. These ropes are secured at their upper ends to hooks placed a few inches in front of the hooks which hold the swing ropes. At their lower ends the ropes terminate in a pair of handles which slide freely up and down the swing ropes. By pulling on



Hand and foot ropes connected with a pair of hollow handles enable the child to operate the swing without assistance

the handles the swing is set in motion. The harder one pulls the higher the swing goes.

The inventor also provides the swing with foot ropes which may be operated in conjunction with the hand ropes or independently of them. These are fastened to the handles in the same manner as the hand ropes.

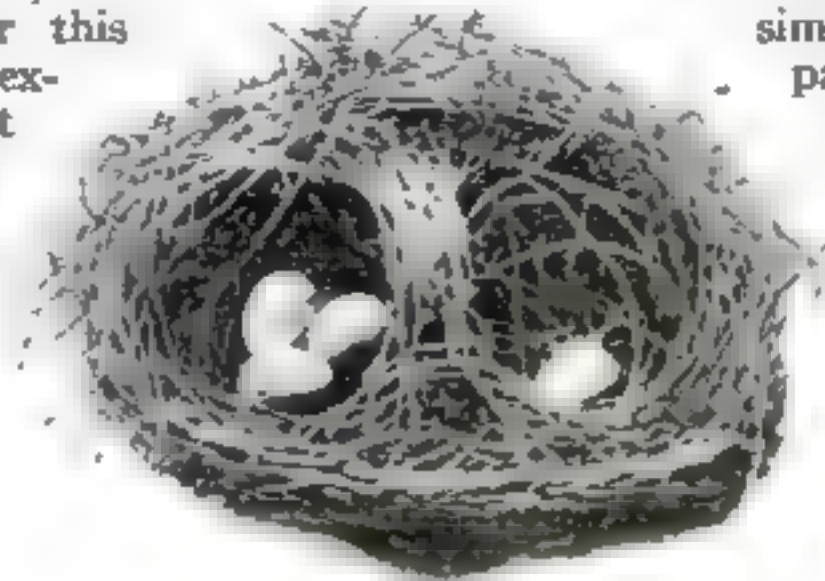
By working both foot and hand ropes the swing can be set in motion almost immediately. By pulling downward the swing is forced forward, and when the handles are released the weight of the child forces the swing backward.

The foot-ropes and stirrups also make it possible for two children to swing together, one operating the handles and the other standing in the stirrups and "pumping" in time with the hand movement. Although designed for the smaller children, the swing is strong enough for a child of any size. Its weight-carrying power depends not so much on the ropes as on the strength of the ceiling hooks.



This Bird's Nest Is Evidently a Two-Room Apartment

BIRDS, like persons, sometimes do strange things. Here is a double nest of a "Chipping" sparrow, an unusual type indeed for this bird. A guess at the explanation would be that a roving bird, probably a cuckoo, which is notoriously lazy and homeless, deposited an egg in the sparrow's nest while she was taking a bit of recreation. When the sparrows discovered it they busied themselves making an addition to the original nest, to which they transferred their own eggs, leaving the intruder's in the old nest to addle.



A freak nest built by a pair of sparrows probably because of a strange egg laid by another bird in the original nest

curious vehicle which plunges through the waves as easily as any boat and which runs on land as easily as any automobile; for Delia is both boat and car.

Now comes M. J. Ravallier, a French inventor, with a smaller vessel of similar design. The accompanying photographs show

this boat on land and emerging from the Seine. It measures about sixteen and one-half feet in length and seats four persons. Its steel hull is supported in front and rear by the usual axle and wheels. The axles fit into watertight tubes which pass through the hull. The craft is propelled by a twelve-horsepower engine. Two distinct transmissions are used.

Which Is It—Boat or Motor Car? It Travels on Both Land and Water

"**D**ELIA the motor duck" is no doubt remembered by readers of the POPULAR SCIENCE MONTHLY. For the benefit of those who did not see her in our issue of March, 1916, let it be said that Delia is a

It Takes About 150 Pounds Pressure to Break an Egg

NATURE executed a wonderful piece of workmanship when she put the shell around the egg. Most of us have an idea that the shell is fragile. It is—sometimes; but scientists have established the fact that

the average pressure under which white eggs break is one hundred and twelve pounds. Strange to say, brown eggs are stronger than white ones. It takes a pressure averaging one hundred and fifty-five pounds to break them, the minimum being one hundred and twenty-five pounds and the maximum one hundred and seventy-five pounds. When

it is considered that the thickness of an average eggshell is .013 and the diameter of the eggs one and three-quarter inches, some idea may be formed of their enormous resistance.



The boat is hauled up out of the water with ropes. After which it proceeds over the land route with a chauffeur at the driving wheel

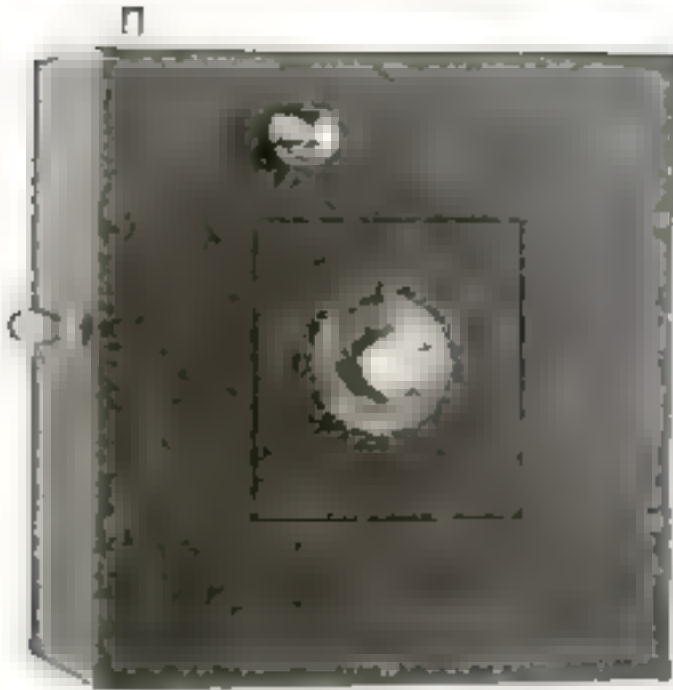


What Makes a Criminal?

Reaching the minds of those
who habitually rob and kill

By Dr. L. E. Bisch

Dr. Bisch is one of the leading authorities on abnormal psychology in this country. He occupied a chair in Columbia University. His work in connection with the establishment of the psychopathic police laboratory of New York city is well known. He is now on his way to France in order to study for the Government the psychological effects of war on our soldiers.—Editor.



Healey's Instruction Box

This wooden box is modeled after the principles of a safe. Oral instructions are given as to the method of opening the door. This can be accomplished only if the steps in the procedure are accurately followed, one after the other. Mechanical manipulation, memory, and the ability to follow instructions are involved in the performance of this test. It may also be suggestive as regards the vocational aptitudes of the subject being tested.

A YOUNG man of eighteen and a companion entered a tenement building. They seemed to be peddlers. They knocked at a door and entered a flat. Within was an old man, confined to a chair, helpless, and stone blind. One of the two peered about to find out if the old man was really alone. The other—the eighteen-year-old youth—took a hammer and knocked the old man senseless. Then the flat was looted. The two robbers were caught as they fled.

Why was such violence necessary? Couldn't the blind old man have been restrained without cruelly beating him? These are the questions of any normal, intel-

ligent being. But these two criminals were not normal. At the Psychopathic Laboratory of New York Police Headquarters the eighteen-year-old thief was found to be mentally about six years old. And that is why he used violence when violence was unnecessary.

Hundreds upon hundreds of such criminals are arrested each year. In New York city alone it has been estimated roughly that each day there fall into the hands of the police between twenty-five and thirty persons who are mentally below the normal to such an extent that they should be examined by experts and placed in proper institutions for life. Only thus can society ever rid itself of a tremendous burden of crime.

No Hope for the Feeble-Minded

Feeble-minded individuals never were normal and never will be normal. All are potential criminals. Because they cannot reason, because they have no moral standards, because they cannot conduct themselves like respectable members of the community, they fall an easy prey to dishonest minds. What



The Mirror-Drawing Test for Accuracy

The subject is asked to trace a design which he cannot see directly because of the cardboard placed between his eyes and the design but which he can see very clearly by means of its reflection in the mirror. Here practice makes perfect." The test in general reveals the subject's learning ability and brings to light many special characteristics.

is more, they follow the natural lines of least resistance. Unable to overcome temptation, they readily go to any extremes which their narrow and stunted thinking may dictate. The "high-graders" and "borderline cases" may deceive one—deceive so well that only the experienced, after repeated and varied testing and examination, can discover their defects. This "almost-normal" type, with his superficial reasoning and cunning planfulness, constitutes the most dangerous class imaginable. At his door can be laid some of the most hideous crimes ever perpetrated.

Once feeble-minded, always feeble-minded. Education may improve, watchful care and studied training may render a defective social and law-abid-

ing, but when once criminal tendencies make themselves manifest, segregation is the only course. We need more institutions where such unfortunates can be cared for and protected, developed mentally and manually to whatever degree may be possible, and given employment and a mode of living best suited to make them useful and happy.

The insane were once normal and are now mentally sick. This in itself means irresponsibility. The proper treatment here is even more obvious. What good is a prison sentence? Surely it does not reform. We are beginning to see that the jail is no place for an irresponsible person. The padded cell is giving place to the hospital. But the change is all too slow. Only too often one suffering from

paresis ("softening of the brain") is arrested, sentenced and jailed; the underlying cause of his misconduct is wholly undetected; perhaps he is looked upon as a drunkard because of his strange antics. Yet paresis is an incurable mental disease that always leads to dementia. So, many mild insanities pass through the courts unrecognized.

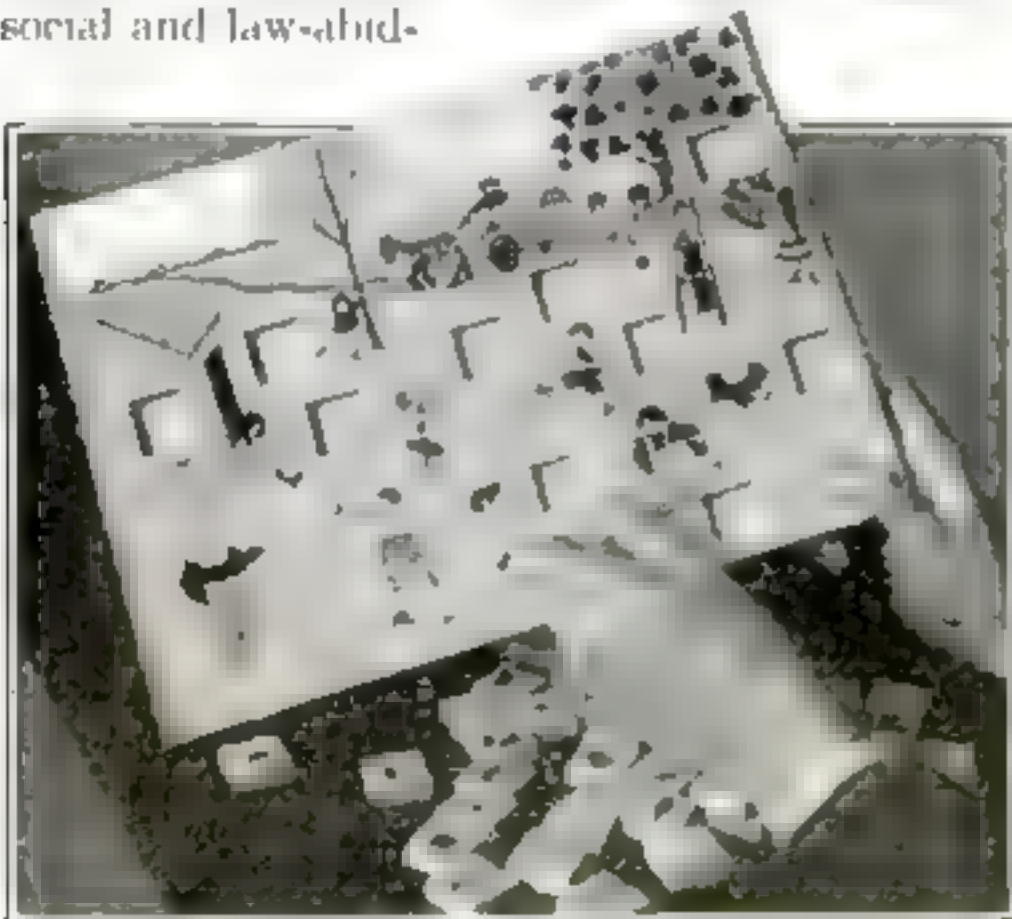
A Laboratory Where Criminals Are Studied

The work of the Psychopathic Laboratory proved a number of things. Of the cases chosen from the daily police "line-up," and the cases examined at the request of Police Lieutenants, Magistrates, Judges of other courts, Department of Correction, and the Parole Commission, about 50 per cent of the first 450 prisoners studied were



The Equilibrium Test

To the trained observer much can be learned from noting a person's powers of equilibrium when in some such position as that here shown. Tremor of the hands, eyelids, face muscles—also marked swaying of the entire body—may suggest the presence of organic nervous disease in incipient or advanced stages



Picture Puzzle Test

This is a highly-colored picture mounted on a wooden frame out of which ten square spaces have been cut. The subject selects from among fifty small square designs those ten which would seem the most logical insertions to complete the picture. Here the subject is inserting a child's boot in its proper space

shown to be suffering from some degree of mental abnormality.

Many of these cases would have escaped the detection of the casual observer. The symptoms were not marked, and only by careful examination was the real nature of the maladies brought out. Many of the cases were hopeful. That is, prompt and energetic treatment would have cured them, so that further criminal practises would have been prevented.

It must not be assumed that all criminals are abnormal mentally. Some, in fact, deliberately enter upon a career of crime just as any person might choose a profession. Still, lack of education, bad companionship, unfavorable home and neighborhood environment play a most important part in the life of a normal criminal. All repeated offenders show a certain amount of judgment-error. They do not learn or do not want to learn that "it pays to be good." Real reformatory measures often help. To stigmatize an individual for life is unfair as well as useless. If a criminal is unsound mentally he should be treated, segregated or both. If he is sound mentally his case should be studied as an individual and a sincere attempt made to reach "the man inside." After such an eliminative process only a comparatively small residual will remain for whom the outlook is hopeless. A beginning has been made in all these fields, but much still remains to be done.

How the Criminal Is Tested

To classify the criminal population was the work of the New York Psychopathic Laboratory. It was proved beyond question that moral deviation is frequently associated with, and caused by, mental defectiveness or derangement.

It is not an easy matter to detect feeble-

mindedness, nor even insanity, especially when characteristic signs or symptoms are not marked or are absent. Numerous tests are necessary. A single test alone is not

significant. It was found at the Laboratory that an investigation of the home conditions, hereditary traits, and even study of other members of the prisoner's family, often revealed most valuable data.

Mental tests are of two main kinds—so-called Tests of Intelligence and so-called Form-Board Tests or

"Tests of Doing." In the first named the use of language is involved and the subject answers a list of questions given, follows written directions, etc. The most valuable of these have been "standardized"—that is, after experimenting upon hundreds of normal subjects of average intellect a determination of the normal response has been made. The replies of any given subject are then compared with this normal standard and so a suggestive grading as to normality and subnormality can be made. In the Form-Board tests the results are interpreted in similar fashion. They are especially valuable in that the use of language is largely eliminated. In most of these the subject places irregularly shaped pieces of wood in a frame—only one arrangement being possible for a successful performance.

This by no means covers the whole subject of mental testing. Many other tests are in general use and the scoring is often difficult. The great value of psychological tests rests in the fact that in this way complicated mental processes are to a certain degree objectified and thereby the personal equation and subjective interpretation on the part of the examiner is minimized. Often numerous procedures and tests that call for special abilities or intelligence reactions are necessary.



The Simple Form-Board Test

Tests of this kind do not involve the use of language and are valuable in examining foreigners. The face test in the illustration was devised by Dr. Knox. The prisoner is trying to place the nose piece where the eye belongs. This test is very simple since each piece of wood has a design of a part of the face drawn on one side of it and only one arrangement is possible

She Launches Seaplanes and She's Unsinkable

A ship which is built to serve as a starting platform for airplanes and to combat the submarine menace

IF water is reasonably clear, a submarine, not too far submerged, can be seen from an airplane. Unfortunately an airplane cannot rise from rough water. Hence, even when used as a scout for a battle fleet in order to determine the number and position of an enemy's ships, the seaplane has its limitations.

Mr. John L. Bogert, a mechanical and consulting engineer of New York city, has designed what seems to us the most practical and brilliant plan thus far proposed for coping with the problem of detecting submarines as well as increasing the possible applications of the seaplane in rough weather. We doubt whether submarines can be detected under water except in the most favorable conditions, but apart from that Mr. Bogert's plan has genuine merit.

Like an eagle, an airplane must be in motion before it can fly. It must run along the ground or the water until it gathers momentum. Since it is impossible to gather speed in rough water, Mr. Bogert proposes first of all to eliminate the superstructures and deck houses found on every ship. All smokestacks, ventilators, masts, boat cranes, deck houses, and obstructions that might injure the returning or departing airplane are either eliminated entirely or made so that they can be stowed away. The wireless masts, as well as the derricks for hoisting the seaplanes on board after their flight, are made to swing from a horizontal to a vertical position. The hatches are flush with the deck.



Bow-on view of the Bogert mother-ship showing seaplane ready for its flight

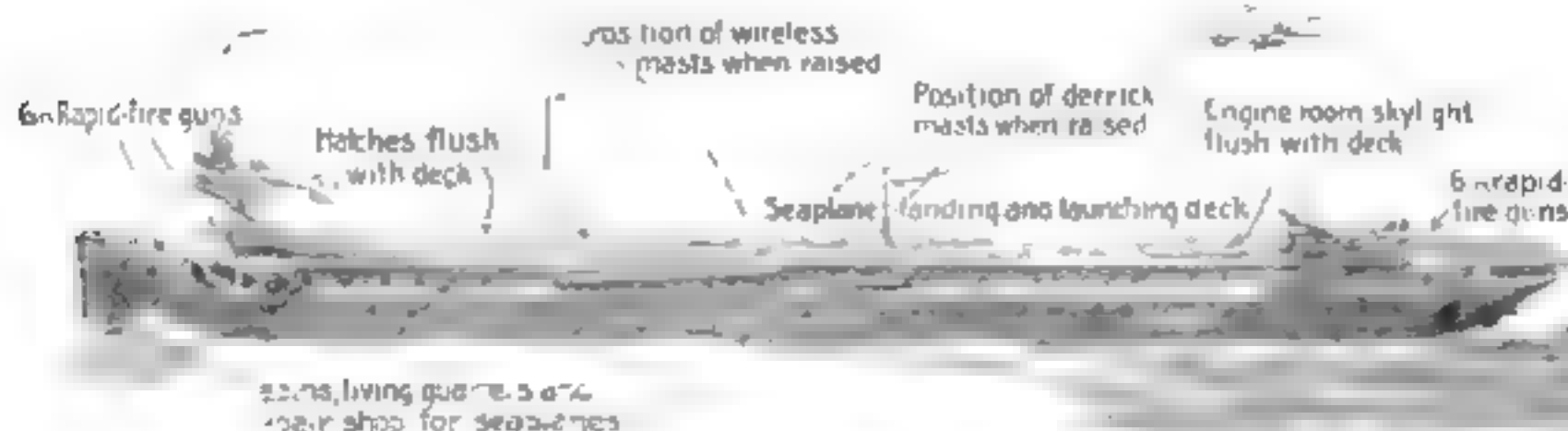
Since the airplane must have a good start, the ship is 560 feet long. Toward the bow, the runway rises so as to provide a good take-off for the airplane. Beneath the take-off is the pilot house.

It is possible for a skilful aviator to land on the deck of Mr. Bogert's vessel. But it is more likely that he would prefer to alight on the water. Should he do so, a crane will hoist him on board again.

Mr. Bogert's mother-ship for airplanes (it can carry at least a half dozen of them) is torpedo-proof. The hull is subdivided by transverse bulkheads and is provided with cellular sides to distribute the force of the explosion of at least two torpedoes. A battery of four six-inch rapid-fire guns is so mounted on the ship that any three can be trained on an object ahead of the stern.

Landing on a deck is not easy, particularly if the speed of the seaplane is thirty-five or forty miles an hour. Mr. Bogert would therefore provide the seaplanes with brakes which would bring them to a stop in about one hundred and eighty feet. This rate of retardation is about twice as great as that of the emergency brakes used on most railways.

Mr. Bogert's ship is to be driven by Diesel engines. Steam, however, could be used if folding smokestacks are adopted.



The masts, funnels, derricks, of Mr. Bogert's mother-ship for seaplanes can be swung down. An absolutely unobstructed deck is thus provided for the launching of the seaplane. The ship is to be 560 feet long and about 80 feet beam. It will be driven either by Diesel or steam engines

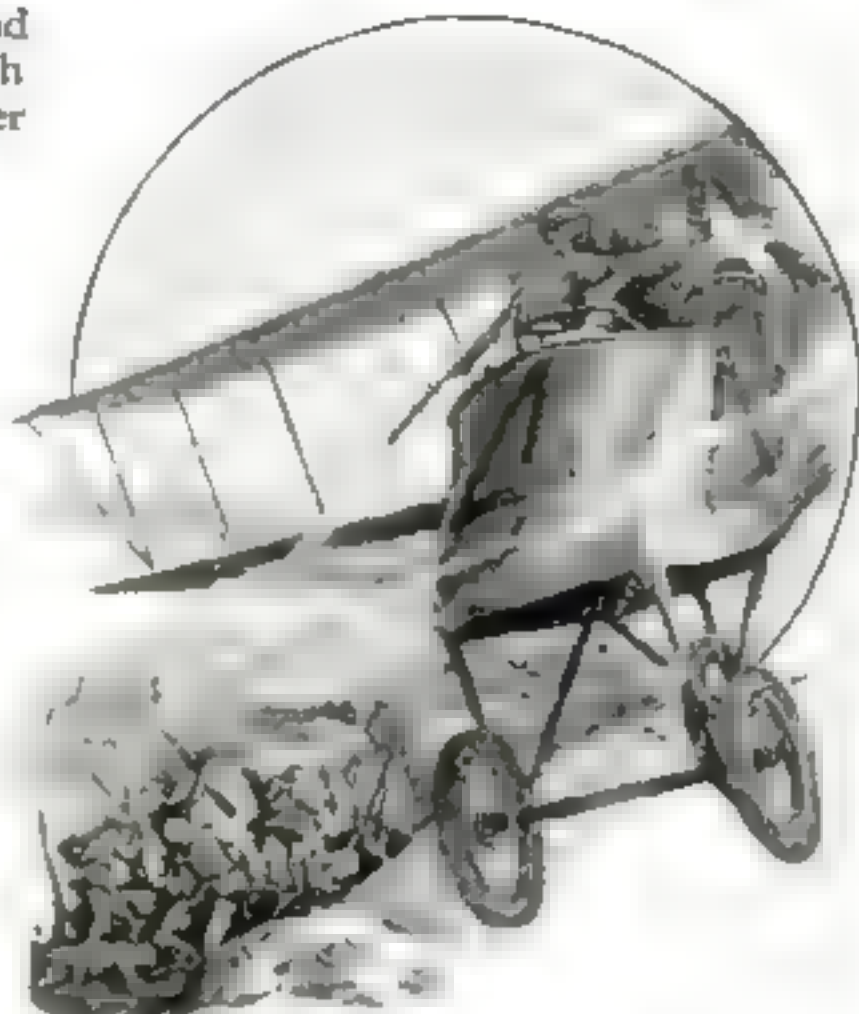
The Charge of the Lightest Brigade

The men in the airplanes swoop down and rake the trenches of the enemy with machine-gun fire—a new military maneuver

By Carl Dienstbach

CONSIDER well the photograph reproduced at the bottom of this page, showing French soldiers engaging in a new kind of target practice. They are learning how to shoot at swift, low-flying airplanes. It is an historic document—this photograph. It shows how formidable the airplane has become in an unexpected way. During more than one charge, airplanes have actually flown ahead of the troops and assisted them in the attack. Flying machines have also deliberately swooped down and with their machine-guns raked the affrighted men in the enemy's trenches from a height of scarcely two hundred feet. Only the other day a pilot dropped down from the skies and shot several German staff officers who were riding in an automobile.

All this is in keeping with what we expect of an artificial bird. Before the war, machines flew at a fixed level in order to avoid the eddies and swirls near the ground. Now they are like hawks and eagles. They swoop down and soar up wheel around,



The airplane swoops down suddenly like an enraged eagle, rakes the enemy trench with a machine gun and flashes away out of range

circle slowly and perform evolutions which even a swallow could hardly emulate. Nor is any attention paid to high winds or to rain.

All this is largely due to



French soldiers engaged in a new kind of target practice, in which airplanes, flying low at the rate of about one hundred and thirty miles an hour, are the objects at which the guns are aimed

the vast improvements that have been made in motors. Without this enormous technical advance men could not fly with impunity close to the ground. As the writer prophesied many years ago, the direct result of this progress is the creation of what may be

termed "a second zone of safety." The first zone lies high in the air, far beyond the range of anti-aircraft guns. Let the aircraft drop close to the earth, let it all but graze church spires, and it enters this second zone of safety—a zone which becomes safe because of the breathless speed with which the pilot flies. Why did cavalry pa-

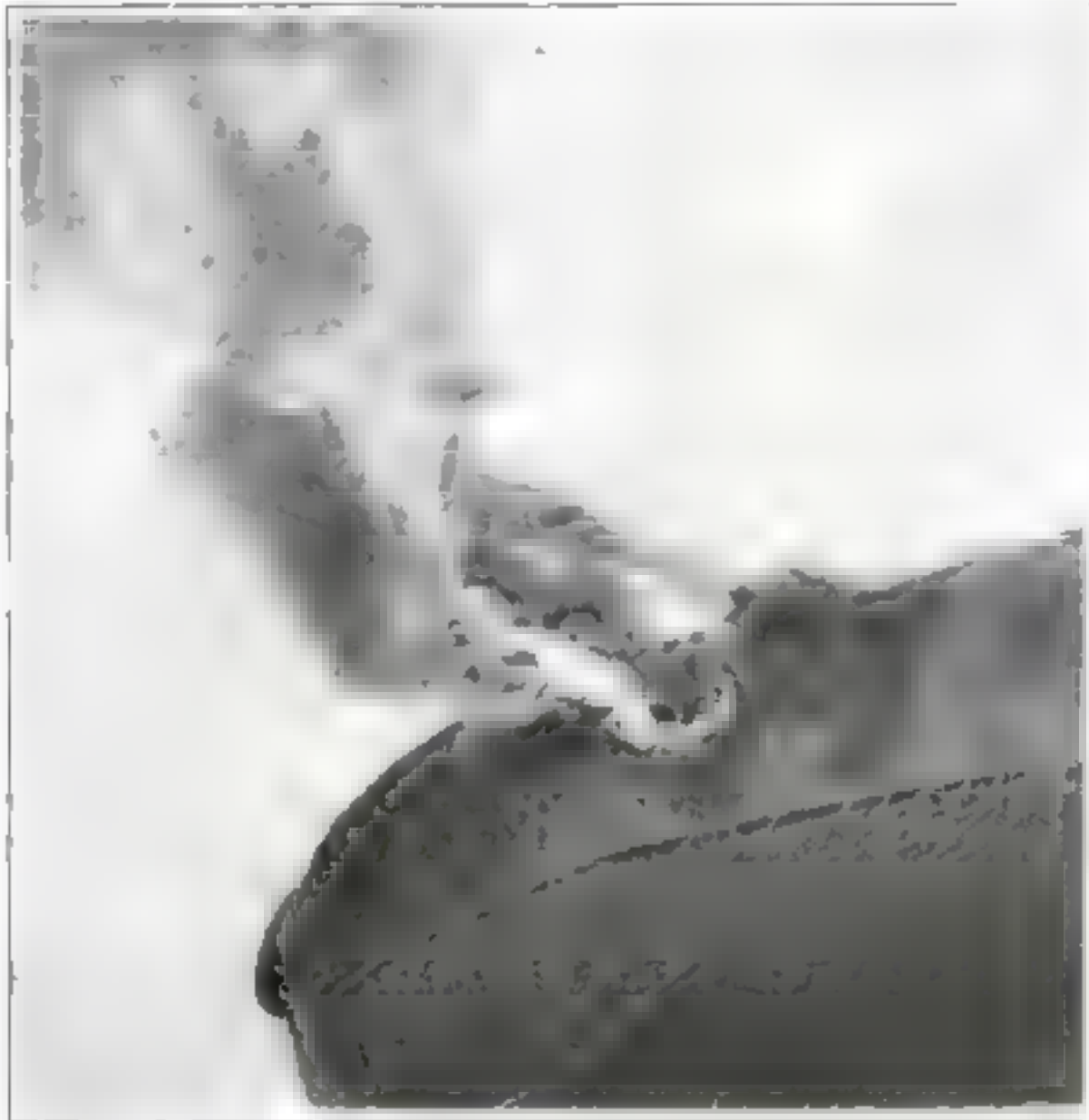
trols, in the old days, ride up boldly upon the enemy? Well do I remember how we were surprised in a sham battle in 1892 by the sudden appearance of three "enemy" hussars who craned their necks over a ridge not sixty yards away. Our captain finally managed to blurt out: "Well, somebody shoot at them." But they were gone long before we could reach the stacked rifles. What is the twenty-miles-an-hour that a cavalry horse can do compared with the ninety-miles an hour expected even of slow flying machines today? Who can hope to hit the small one-hundred-and-thirty-mile-an-hour fighter as he flits over the ground?

As soon as the airplane developed its full power of flying near the ground as well as high up in the azure, it became a real bird of prey, fighting in the only efficient way that a bird can fight, which means at close

range. This development is simply the automatic outcome of the perfected art of fighting with airplanes—likewise efficient only at close range. After an air-man feels certain of himself, it is second nature to apply the same methods close to the ground

—just as the falcon fights a weasel. And so the "second zone of safety," near the ground, was quite incidentally discovered.

Alpine hunters must learn how to fight enraged eagles. The troops in the trenches must contend with machinegun bullets coming from above. Now do you see why that photograph is an historic document?



© Int. Film Serv.

Hundreds of captive balloons are used by each of the armies. Artillery officers watch the effect of gunfire from their baskets. Airplanes attack the balloons and drop bombs upon them. The balloons go up in smoke, while the officers descend

Let Cheese Be Your Principal Meat Substitute

A POUND of cheese supplies more than twice as much energy as a pound of fowl or round steak and almost twice as much protein as the same amount of fowl or ham. It is, pound for pound, more nourishing than any meat. Why, therefore, do we not use it as a substitute for meat?

According to the Department of Agriculture we do not appreciate the value of cheese as a food; we think it is indigestible. Yet more than ninety per cent of the protein of cheese is digested and ninety per cent of its energy is available. For this one reason alone it should form an important part of the daily fare. When cooked it is as easily digested as any other article of diet.

Put These Webbed Gloves on and Swim Like a Duck

HOW would you like to be able to swim as fast as a duck, and with as little effort, with webbed hands and feet to push your way through water?

It is not at all impossible, now that Dr. A. Kandor Zawadski, of Honolulu, has invented his swimming glove. As the accompanying photograph shows, the webbed glove makes a veritable duck's foot out of the human hand. When swimming, the gloved hand is spread out at each backward stroke and closed each time the hand is drawn forward. According to the inventor, a swimmer equipped with the duck-like hands can not only outdistance other swimmers but the hands enable him to stay up for hours with slight exertion.



The swimming glove, made for both hand and foot, is webbed like a duck's foot and will keep the swimmer afloat

Statistically, What Is Your Chance of Being Killed in This War?

IF you, a drafted man, believe that statistics tell the truth, you will feel as safe in France as you usually do in the streets of New York. So says Roger W. Babson, the eminent statistician. Furthermore, he says that the man who is connected with the heavy field artillery is no more likely to be killed than one in the employ of a railroad. However, he does not hold out such high hopes for the lieutenants, sergeants and corporals, the death rate being very much greater among officers than among privates. Also, the mortality is higher among volunteer corps than among drafted men. Sixty men per thousand are now being killed in the war, and about one hundred and fifty men out of each thousand are wounded.

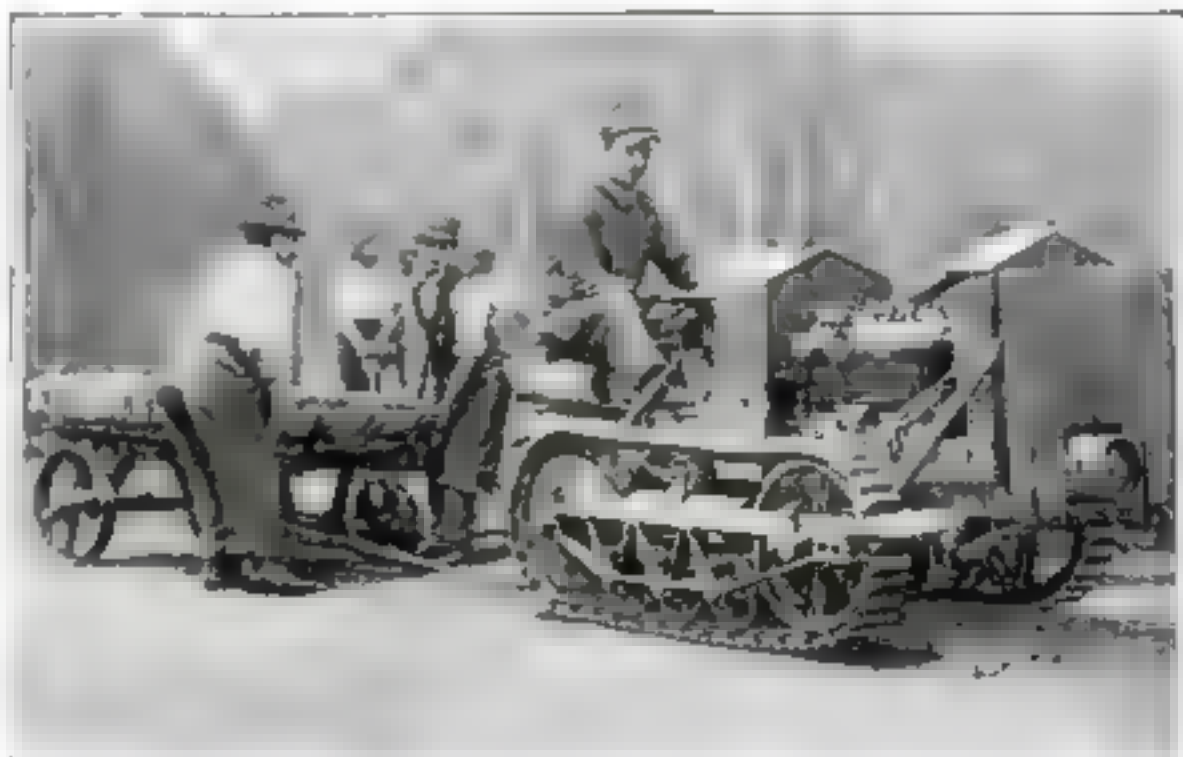
The Small Caterpillar Tractor Rings the Death Knell of the Industrial Railroad

A SMALL tractor of the conventional caterpillar type which is designed as a substitute for the narrow-gage industrial railroads operated in connection with large plants, has recently made its appearance. It can move material rapidly from one department of a factory to another and pass obstacles, since it does not require roads or tracks for its operation. Furthermore, it does not mar the surface over which it passes, because it lays its own track as it goes along.

For this reason it can be used inside factory buildings. It can pass through doorways of the ordinary size, and when not used in transporting material from one department to another, it can be employed in the shipping room or on the loading platform. It is but fifty inches wide and

fifty-two inches high.

There are any number of other uses to which the industrial tractor may be put. For instance, it can be employed for pulling loaded wagons out of excavations, or it can be used in logging camps, or in lumber yards, mines, and shipyards.



The new caterpillar tractor adapted for commercial use in manufacturing plants. It can be used inside and outside a building and as a substitute for the industrial railroad

Lowering the Life-Boats by Means of Gear-Operated Davits

TO make possible the rapid lowering of lifeboats, Everett W. Myers and Aaron E. Sharpley, of Key West, Florida, have devised gear-operated swinging davits.

Each davit is provided near its shank and close to the deck with a gear, with which a bevel gear carried by a crank shaft meshes. When the boat is to be lowered the cranks swing the davit arms toward each other and thence outwardly to lower the boat. A cover plate over the gear protects it from water and from rusting.

The Camouflage Soldier—A Decoy for the German Sharpshooter

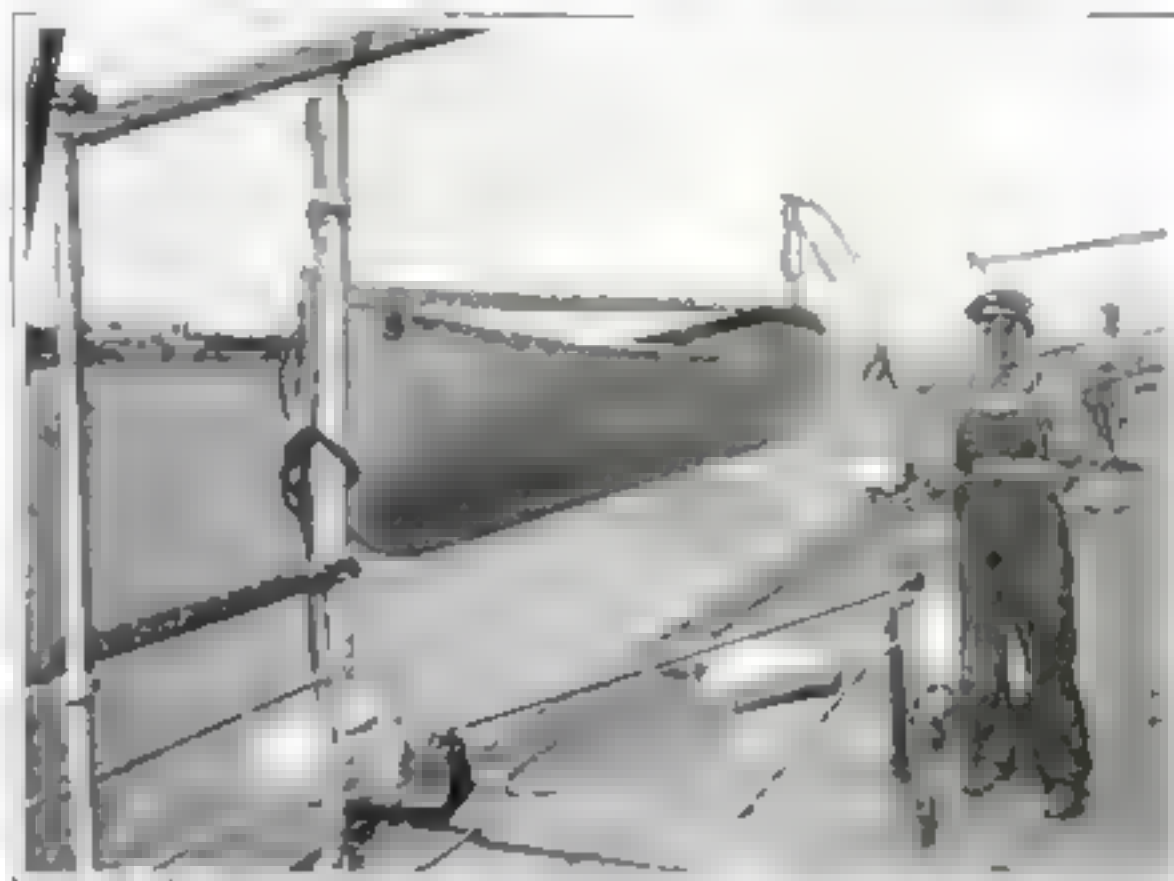
WE have heard of tin soldiers but it has remained for J. Burgess, an officer in training at Fort Sheridan, Illinois, to bring to our attention a camouflage soldier of papier mâché. His plan is to

place a large number of these dummy soldiers beside the regular troops on the firing line, to serve as decoys for the Germans. Unable to distinguish between the real and faked soldier, he believes the Germans will waste a great amount of ammunition on the papier mâché figures.

In this instance, every hit will be as good as a miss.

Study the accompanying photograph and you will see the papier mâché figure at the right of the inventor. It is not easy to distinguish one figure from the other. At a distance of from fifty to one hundred yards, say, it

is extremely doubtful if the Germans could do so. The dummy figures cost practically nothing to make, and they can be molded to represent a soldier in any one of a number of firing positions. Whether it would be wise to place the dummies beside troops in the trenches is open to doubt, but there is no question but what a party of sharpshooters could use the figures to advantage. They could certainly be used as decoys.



When the boat is to be lowered, cranks swing the davit arms toward each other and outwardly after grasping the boat



The dummy soldier, made of papier mâché, is seen at the left of the picture

Do It With Tools and Machinery



A device for locating trouble in cylinders. It has an insulated handle attached to a current-carrying chain, the two ends of which are grounded.



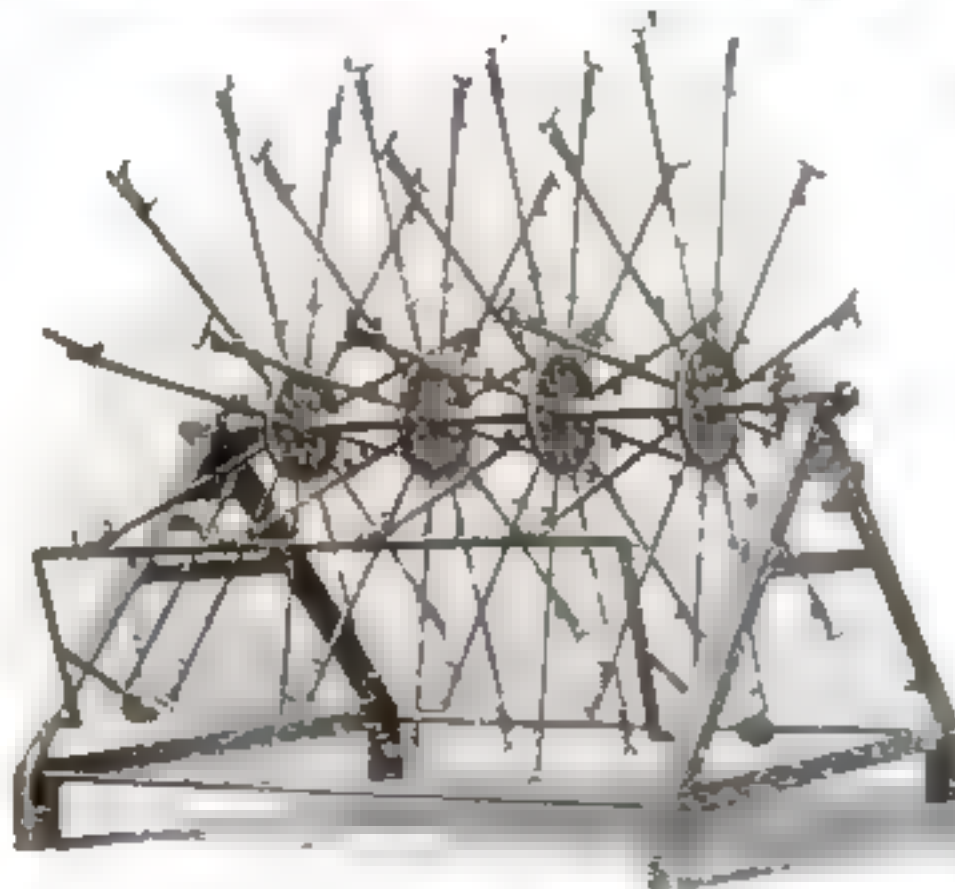
An oil burner for heating the materials when mixing concrete in cold weather. The burner consists of steel pipe with an elliptical cross-section and with a short bend in the lower end to direct the flame. The storage tank is placed on top and holds sufficient for a two days' run.



The modern carpenter takes his shop to his work. At right is shown a small gasoline engine for driving the saw and jointer in a portable shop.



A particularly tough flexible boiler stay-bolt for use in engine fire-boxes.



Each end of the many arms on this shaft is an individual clasp for holding stock to be glued so that many pieces may be done at a time.



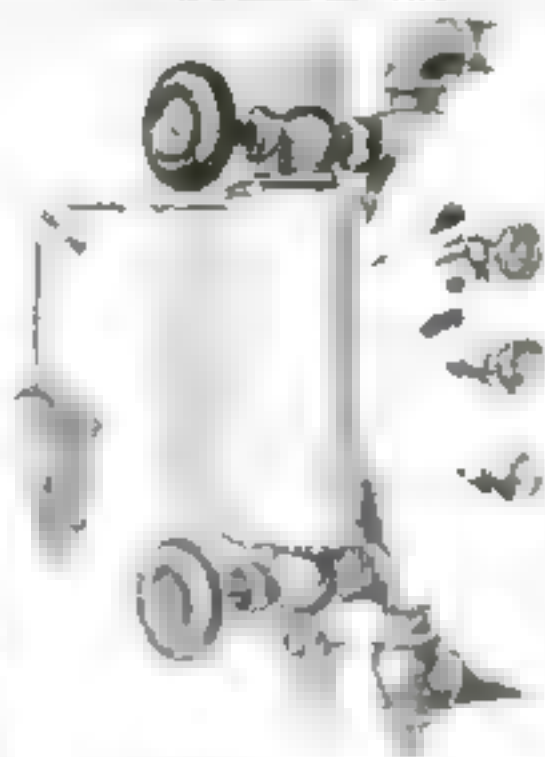
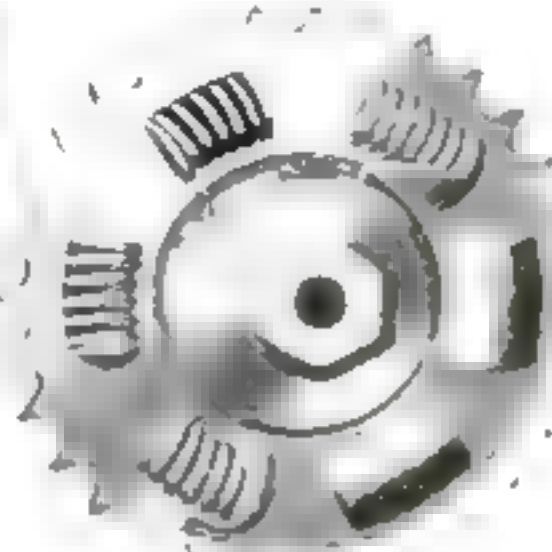
A hammer having an enlarged handle to reduce the shock of heavy blows. The inner metal portion has a cushioning effect.

Do It With Tools and Machinery



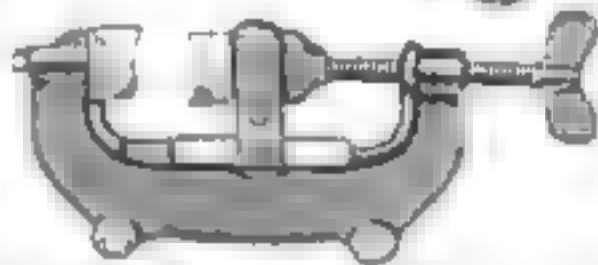
A ratchet auger handle convenient when boring holes in places difficult to reach. The handle is easily taken off

Below: A cushion sprocket for eliminating the jerky action of a motorcycle engine. Coiled springs in the web of the sprocket take up all the pull



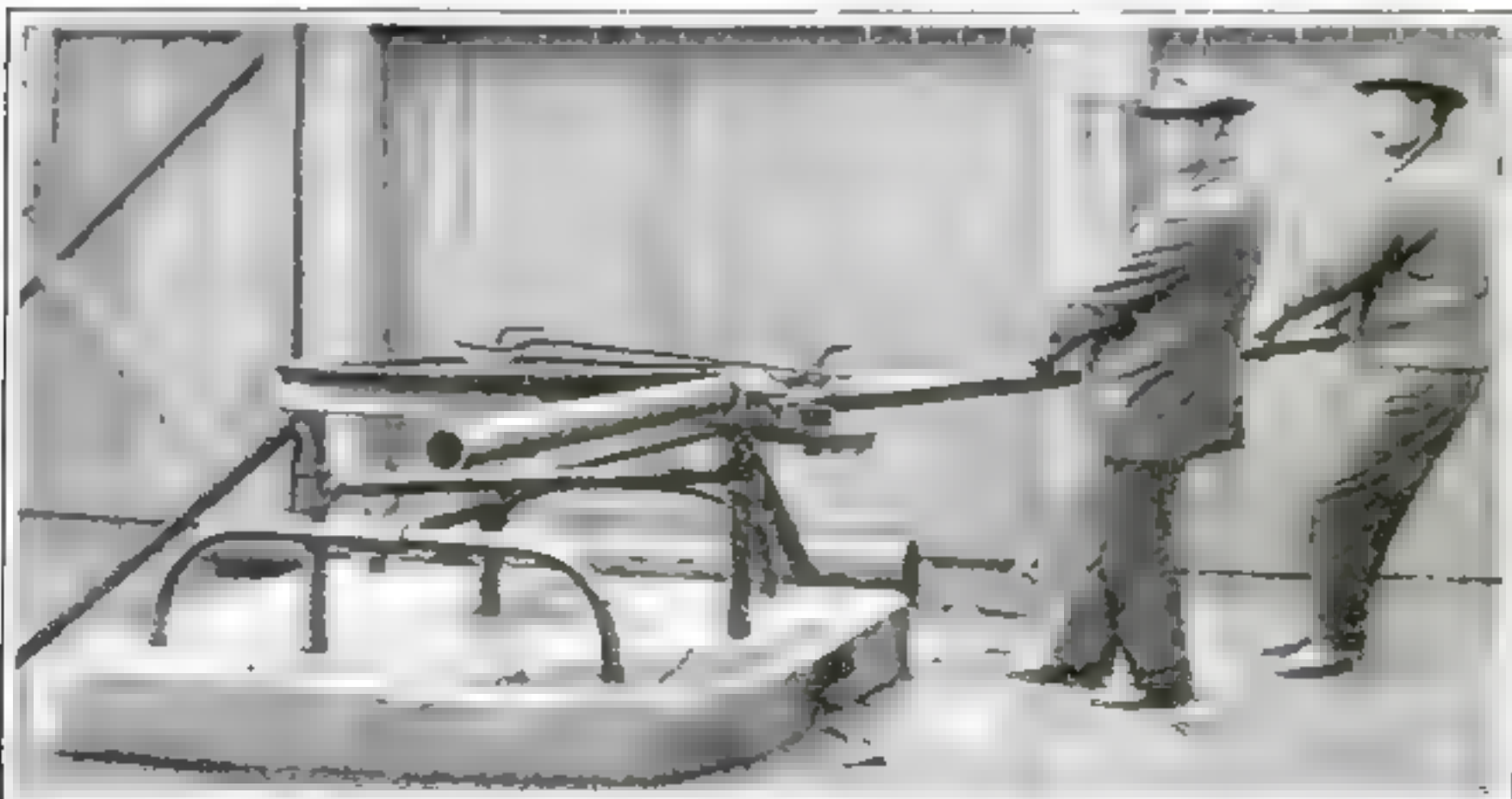
Above: A shutter which can be operated from a distance to close the engine cocks when the water gage breaks

Below: A pipe vise specially devised to be carried in the tool kit. It weighs only four pounds



Above: This awl carries its own spool of waxed thread. You do not need to break off the strands to sew

Below: A wrench with curved handle and readily adjustable jaws

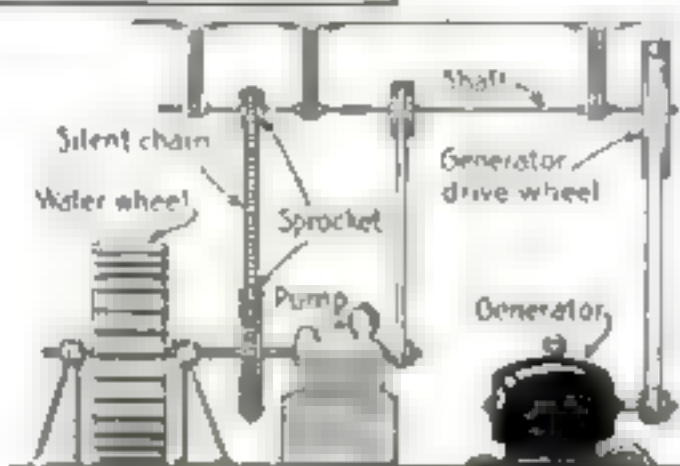


A machine for bending steel, iron, brass and copper pipe without cracking or crimping the metal. It is equipped with interchangeable heads to take different sizes of pipe



A modern water wheel placed on an ancient mill site furnishes current for one hundred electric lights

The mechanism of the electric-generating system. The wheel develops about ten horsepower



His Lighting Bill Is Twenty-Five Cents a Month

AN old water wheel on the estate of Frank B. Moore, at Trenton, N. J., is made to run an electric light plant and to pump water for three acres of trucking ground at an approximate expense of twenty-five cents per month for lubricating oil—the water doing the rest.

The property now occupied by Mr. Moore was formerly a deserted mill site. The old stone residence was erected in 1775. The miniature mill seen in the illustration is built on the old mill site, the lower floor being used as a pumping station, machine shop and garage, and the upper story as a recreation room.

The wheel is ten feet high and three feet wide. It is mounted on roller bearings and develops about ten horsepower.

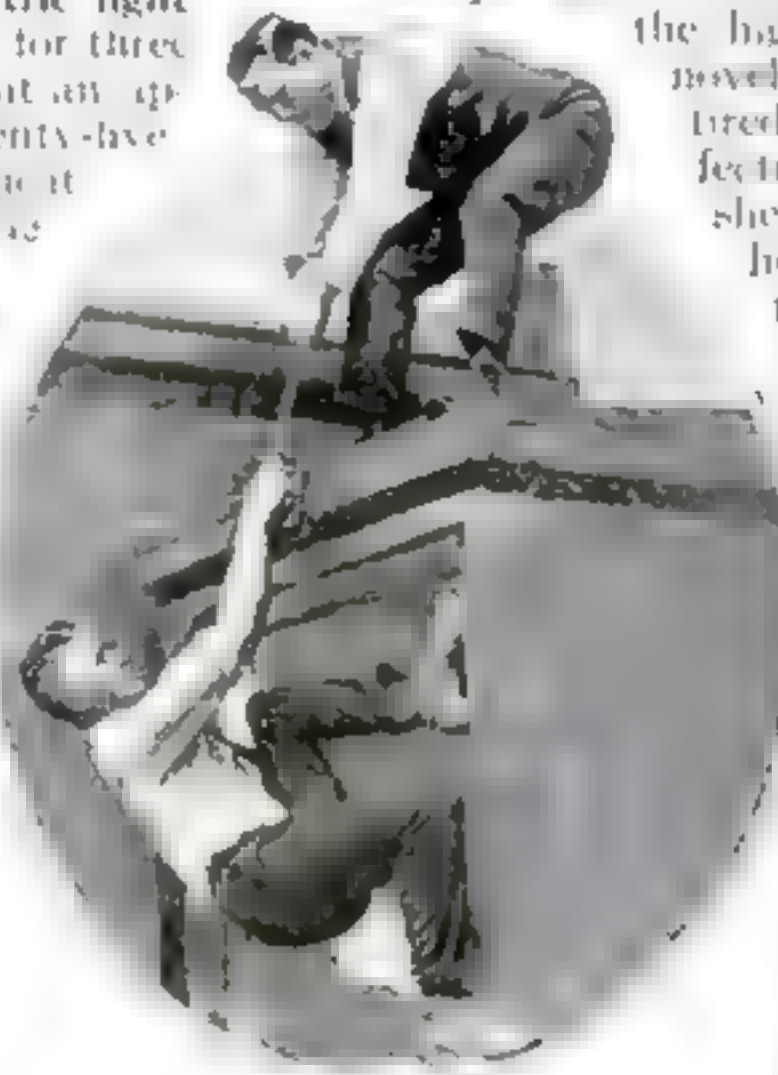
It is geared to the shafting by means of a silent chain drive. The generator and pump are driven from the shaft by an ordinary belt system. The lights, more than a hundred in all, are supplied by direct current without the necessity of storage batteries. However, there is a surplus of lights, so that in the near future both water wheel and fountain are to be illuminated at night. Under the waterfall and dam is a milk house.

Maltreating a Rubber Water Bottle to Test Its Strength

NO; the photograph shown below is not a thriller intended for the motion picture screen. It is merely a record of a test made by a rubber goods manufacturing company to find out how much strain their hot water bottle would stand.

First a girl was allowed to have fun with it after it had been filled with water, by using it as a punching bag. But she did not punch it about in the ordinary way. She wore metal "knuckles" such as the highwaymen in the dime novels use. After she had tired herself out without affecting the bag in the least, she turned it over to four heavy-weights. Each of them took a corner and pulled with all his might. Still the bag held.

Several tests were made but the final one was most exciting. The man who made it risked his life. He weighs one hundred and sixty pounds; but with only the bag as a rope he allowed himself to be pulled up from a window to the roof of the building—and there was no accident to himself or to the bag. After this test the official "OK" was given without reserve.



Testing the strength of the rubber in a hot water bottle. It was used in this case as a life rope without accident

How You Light Your Cigar When Traveling in Italy

THE Italian substitute for the neat and convenient cigar lighter found in every American cigar store is a long rope lighted and placed outside of the tobacco shop. It is made of cheap hemp, of rope waste, and even of ragstwisted roughly into shape and held together by strings of twine. The improvised lighter is made by the storekeeper himself.

A tourist making his way down the main street of a town in Italy will find strings of these ropes all along the way.



© Brown and Dawson

A slow-burning rope twisted from waste is the "lighter" of the Italian cigar keeper

on a heavy metal base mounted on rubber pads so as not to scar or scratch a desk. It consists of a metal framework, handle-

plunger, a combined water-tank and moistening wick, a stamp-counting register and a platform on which the envelopes are laid to be stamped.

The back of the framework is hinged at the bottom to open in order to insert rolls of five hundred or one thousand stamps in ribbons, one stamp wide, as furnished by the Government. The roll, slipped over a pin in the hinged cover, is fed forward by a system of levers operated by the downward push of the handle. Thus the strip of stamps

Stamping Two Thousand Letters an Hour with a New Machine

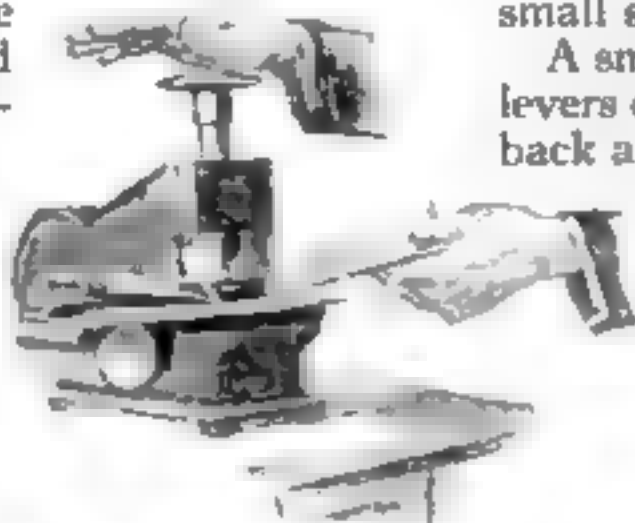
GONE would be the stamp-licker and the wet sponge were every office furnished with this new mechanical stamper having a capacity of two thousand letters per hour. This machine differs from others of its kind in that it moistens the envelope instead of the stamp and in this way does away with the possibility of the stamps gumming and thereby preventing the successful operation of the machine.

The machine is built up

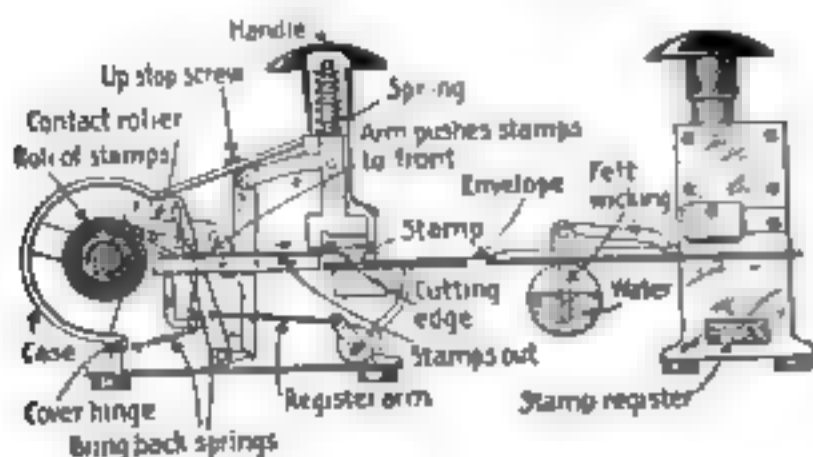
is automatically fed out to a point beneath the base of the handle-plunger and automatically cut off at the proper perforation just when it is affixed to the moistened envelope. The system of levers is brought back to its original position at each release of the handle by means of several small springs.

A small rod attached to one of the levers of the system is made to move back and forth at each depression of the handle and to operate a register with a dial on the front of the machine, which dial indicates the number of stamps used. The stamp device may also be locked, so that no stamps can be removed. By means of the register, an accurate count of the number of stamps can be kept for any given time.

To affix a stamp the corner of the envelope is shoved under a moistened wick. The handle is pressed down and then springs back automatically.



The corner of the envelope is moistened with water fed from a tank through a wick, ending just above the envelope platform at the right of the plunger base. Then the handle presses the stamp on



A Houseboat of Marble Built to Amuse Chinese Royalty The Airplane to the Rescue of Storm-Tossed Mariners!

THE most beautiful and perhaps the most costly houseboat in the world is the one illustrated on this page. It is made entirely of marble and served to amuse the household of Chinese royalty.

When the boat was built no one knows. It floated on a small lake within the precincts of the "Forbidden City" in the last days of the Manchu dynasty. Recently it was removed to the national park in Peking.



The marble houseboat is exquisitely carved and has elaborate trimmings of solid gold. It is enormous in size.

"Do It Electrically" Also Applies to the Up-to-Date Barber

AN electrically operated hair cutter which entirely eliminates the shears has been devised. It consists essentially of a light standard with cross-arms at the top to support a small electric motor connected with the clippers by a flexible cord three or four feet long. In cutting long hair the fingers and comb are used in exactly the same manner as with shears. In outlining the hair in front the cutters are turned upside down and the points pressed close to the skin; this produces a straight line without danger of cutting the skin. When the cutter is held in the same position and passed rapidly over the hair stray wisps are removed.

The hair is cut in a fraction of the time usually required.



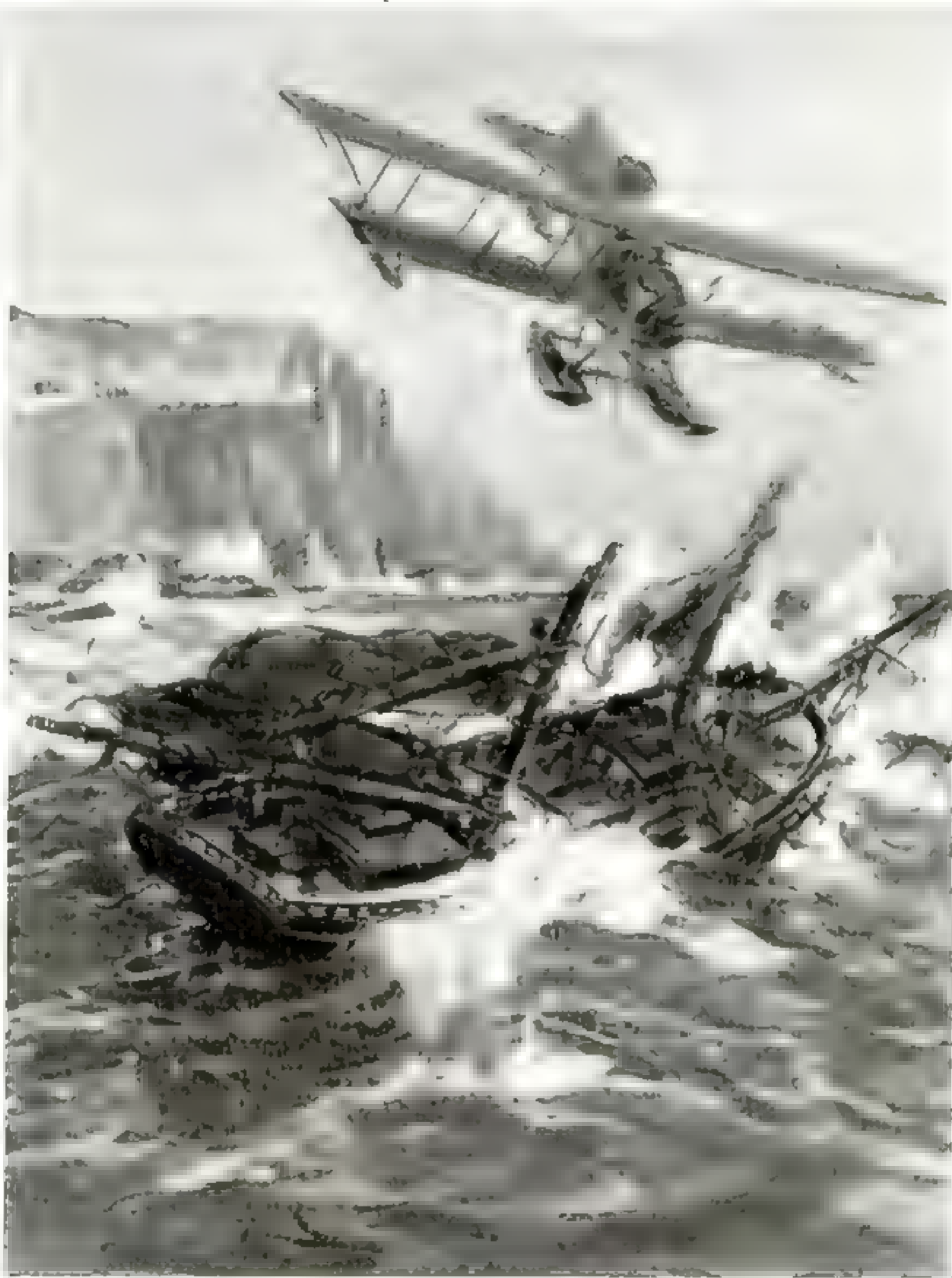
Cutting the hair electrically with clippers instead of shears

keep their puny shell from being dashed upon the rocks? During the great storms off the coast of Maine, for instance, the experienced guards well know the uselessness of any attempt of reaching ships in rowboats. Rockets or cannons are brought into action immediately and with these the guards attempt to shoot lifelines out to the foundering vessel.

With these lines, it is often possible to carry the sailors off the vessel in hawsers. Notwithstanding this admirable method, there are times when the lines do not reach the sinking ship and crew. Rocket nor mortar is powerful enough to carry the heavy lines against the wind, far off the land. But shall we let the sailors perish, because of that? Not while there is a way out. And that way is with the airplane, the next great servant of man that is coming as soon as the world sees a righteous peace. The airplane is a rider of winds, and sixty-mile gales will never prevent it from carrying a lifeline to the ship! The plan has already been worked out by the United States Coast Guard.

MORE than a hurricane on the high seas do sailors fear even sixty-mile gales near a rocky coast. To the life savers, also, a rocky coast is most dangerous. In any attempt of theirs to reach a vessel that is doomed, what is to

Throwing Out the Lifeline by Airplane



Sailors on a schooner fear nothing so much as a storm off a rocky coast. Once the wind carries them against a rock, the ship is lost! It is useless for the life guards to attempt to reach them their only hope lies in a rocket or mortar which can shoot a lifeline to them. When these fail, the only hope of getting a line to the seamen, is with the airplane

The Bomb-Droppers Are Coming! Hug the Ground

THIS is the advice which is being given to the school children of Sussex, England. They are being drilled daily in dropping suddenly face downward and remaining perfectly motionless on the ground, just as our school children are put through the fire drill. The reason for the ground-hugging is not quite clear to us, unless it is to make the street appear deserted to the bomb-throwers in the air.

Heretofore the people of England have been so careless in regard to their behavior during an air raid that they have played into the hands of the raiders, so to speak, by flocking to the roofs of their houses and swarming the streets in order to get a good view of them. This led to an official edict requiring all persons to get into and keep inside their houses or any available house when a bomb-dropper was reported in sight.

If Your Eyes Are Weak Use a Less Brilliant Desk Light

IF you have a sense of faulty vision it is a natural inclination to seek a very strong light by which to read or study. This simply adds to the eye strain. The best light is an indirect, diffused light of sufficient strength to make the letters on the page stand out in uniform distinctness. Avoid the brilliant reflection from metallic objects that may be on the desk.

Torpedoed! But the Cargo Floats Off Safely

THE question of saving the cargo of food-stuffs on a torpedoed ship has received what seems to be a practical answer by W. G. Durant, of Jacksonville,

Florida, who proposes to seal up the cargo in galvanized iron containers which will float on the surface of the sea after the ship has sunk. His idea is not unlike that of Menotte Nanni, which was described in the March issue of the *POPULAR SCIENCE MONTHLY*.

Mr. Durant plans to make his air-tight containers large enough to hold cargo weighing from two to fifteen tons. Each tank is to contain a compressed air chamber to afford the necessary buoyancy, and each is to be equipped with a hook and chain, so that a large number of containers upon

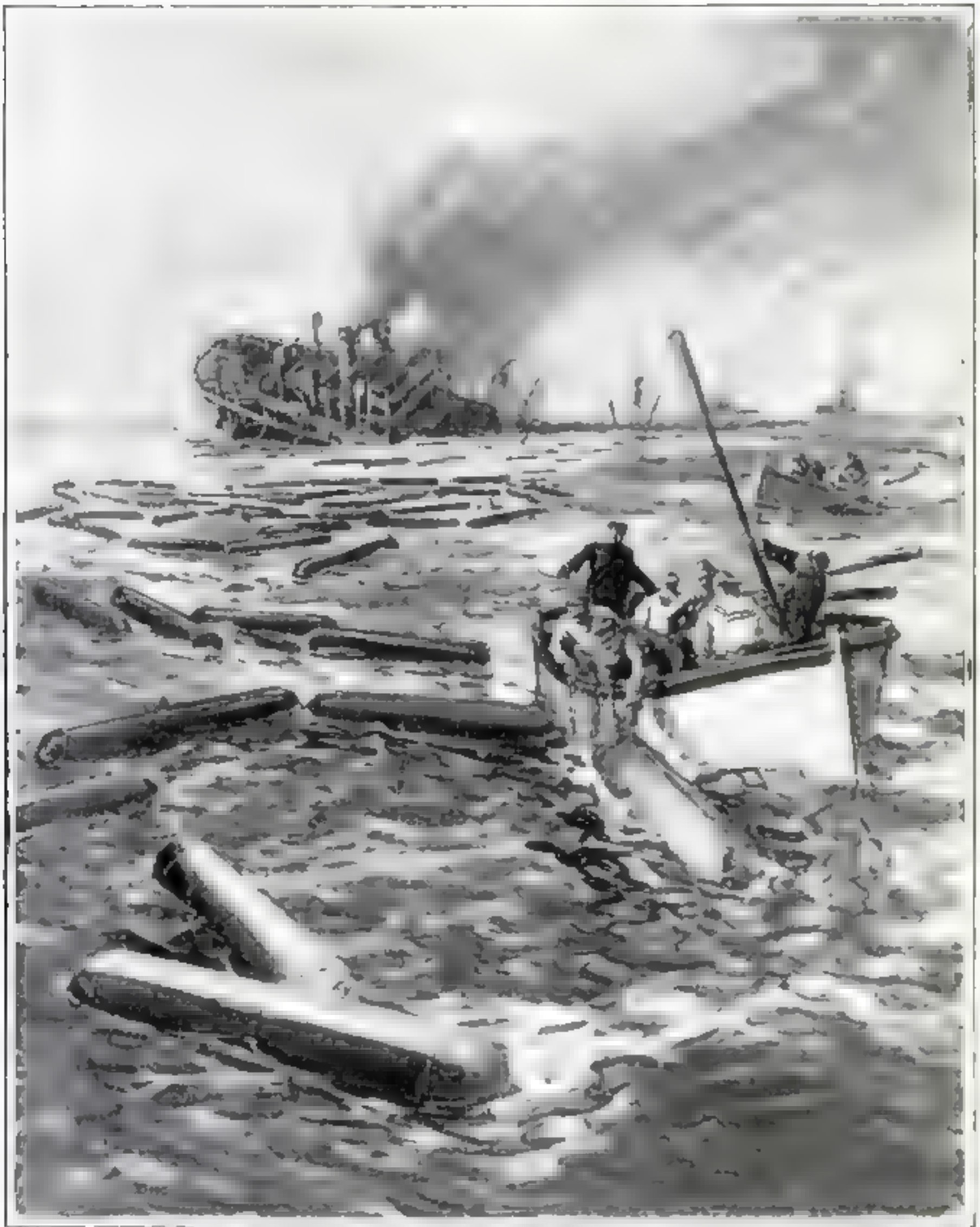
floating to the surface can be fastened together and towed to land. The crew of the torpedoed vessel could use the floating containers as life rafts.

So far as the destruction of the containers goes, it would not be practicable for a submarine to waste torpedoes on them. Of course a submarine could shell as many containers as it wished, but this would not continue for long with so many vessels patrolling the barred zone.

A feature of Mr. Durant's plan which is more important than the containers themselves, is the ship which will carry them. The inventor does not favor the ordinary design of ship, but he suggests a ship without decks to enable the con-



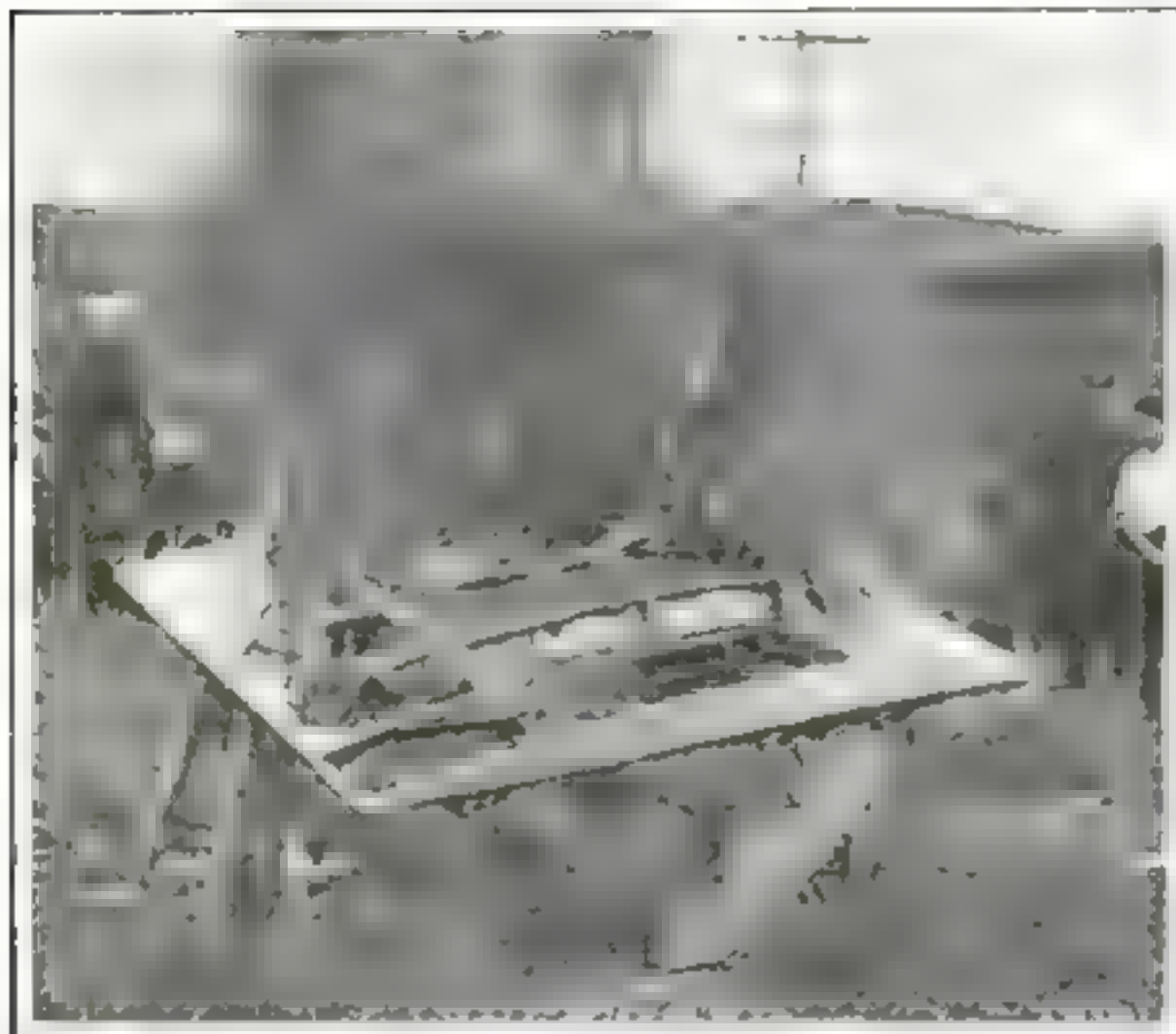
School children of Sussex, England, in a ground-hugging drill to be practised during an air raid



The food cargo is carried in air tight, water tight containers which float on the water when the ship goes down. Each tank contains a compressed-air chamber to provide buoyancy

tainers to rise to the surface and with the engines and boilers located in the center and the cargo containers fore and aft. A ship so built that the containers could be placed in the hold, with the decks merely pinned over them, is also con-

sidered. With such a ship the containers could easily force the decks upward when the intruding water caused them to rise, and come to the surface. They could float about on the water for days if necessary until salvaged.



Underside and Underwing

A demonstration of what happens to an airplane wing which has not been coated with the fire-proofing liquid when a spark of fire comes in contact with it

Protecting the Airplane with a Fire-Proof Coating

A NEW varnish or coating for airplane surfaces which makes them fire-proof has been introduced by W. R. Weeks, of New York city, who is interested in the treatment and waterproofing of fabrics. Of late there have been a number of so-called fire-proof paints and varnishes proposed for the airplane. Without exception they have proved worthless when submitted to a rigid test. Furthermore, they have caused delay in turning out machines, because a number of coats of the fire-proof paint had to be applied one coat after another after the usual painting of the airplane was completed.

The new coating manufactured by Mr. Weeks is conceded to have several advan-

Forty-Three Bombs in a Freight Car Load of Scrap Iron

FORTY-THREE bombs hidden in a freight car loaded with scrap iron bound for the furnaces of a big foundry in Chicago, were discovered by the keen eyes of Government agents recently. The discovery was made through the watchfulness of George Marmann, the man shown in the photograph, who became suspicious when he noticed the round objects mixed with the scrap material. He told his superiors of the fact and they, in turn, communicated with the Department of Justice. A subsequent examination of the bombs brought out the fact that there was enough explosive matter in each of them to blow up a half dozen foundries and do incalculable damage.



Twelve of the forty-three bombs found in a freight car loaded with scrap material for a Chicago foundry, and the man who discovered them

The Rising Price of Automobiles—Charge It to the War

THE policy of automobile manufacturers of yearly reducing the price of their cars has received a severe jolt. With steel, copper and rubber going out of the country as they have, the rising cost of these materials promises to sweep the price of the cars up with them.

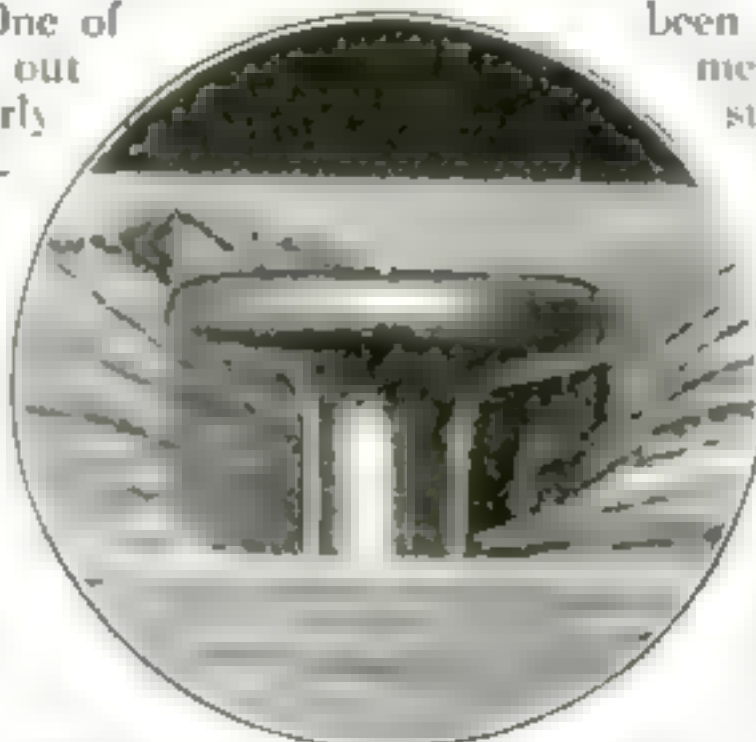
Steel for forgings has gone up nearly three hundred per cent since the beginning of the war. Aluminum quotations are trebling those of two years ago. Leather, copper and other finishing materials have advanced from twenty-five to one hundred per cent. Even the cost of the labor, the largest single item in the manufacture of a motor car, is considerably greater than it ever was before.



The framework into which the concrete is poured is a part of the permanent structure and hence need not be removed

The Overdriven Nail and the High Cost of Living

ONE wooden packing case is required with every twenty-four of the billions of cans that America uses in her canning industry each year. The expense of the cases, when everything is added up, is so great that packers are availing themselves of every invention or idea which promises to reduce it. One of the facts they have found out is the economy of properly adjusting the automatic case-nailing machines. When the strokes of these machines are even a fraction of an inch too long, the wood fibers are cut and the havoc is wrought which the accompanying enlarged photograph well illustrates. It seems a more economical plan to pay a workman to adjust the machine than to stand the expense of repairs.



The havoc wrought by an overdriven nail in the fibers of a packing case

A Substitute for Forms in Concrete Roofs and Floors

THE necessity of erecting temporary wooden forms for concrete roofs and floors is avoided by the use of a metal support which becomes a part of the permanent structure and which not only takes the place of reinforcing material but also helps carry the load. When the framework has been put up, large sheets of the metal work are laid over the supports and fastened; then the concrete is poured, the under side cement plastered, and the job is complete.

Less time is required than with the ordinary forms. In addition there is less expense for labor and material, and the concrete work may be made lighter. The metal material may also be used for concrete work in other construction than that of roofs and floors.

An Iron Worker's Steel Glove. It Is As Flexible As Leather

A GLOVE which will give as much protection to a man's hands as a glove of rigid steel, yet which is as flexible as any glove of leather, has been developed by a Western manufacturer. It is not the quality of the steel which is responsible for these properties; but it is the clever way the ribbon steel is interwoven in the leather. The steel ribbons are woven across the width of the glove so that the fingers can be flexed in them with perfect ease.

The ribbons being close woven, they afford foundrymen and mechanics a perfect protection from the sharp and ragged edges of iron pieces. Moreover, by bringing the stitches of the ribbons to the surface at every wearing point, the glove, rather than the hand, gets the rough usage. The steel stitches thus also protect the leather, so that the gloves will last indefinitely.

Such a glove will be found a boon in such work as sand blasting, in iron turning, iron grinding and chipping, and even in wood working.

The "Red Cross" for the Soldiers; the "Red Star" for Their Steeds

WITH the advent of the United States into the war, the American Red Star Animal Relief Association springs into prominence. It is an organization which does for the horses what the Red Cross does for the soldiers. The association has branches in most of the European countries and its work is authorized by the Secretary of War.

Its main objects are to found veterinary hospitals and furnish veterinary attention and supplies wherever needed. It is pointed out by the organizers that the care and conservation of the animals used by the army is an important patriotic duty and will contribute directly to the success of the army operations.

Inspecting the Six-Mile Gunnison Tunnel by Automobile

SOME time ago we printed an account of the inspection of a sewer by motorcycle. Now comes a description of a trip through the Gunnison tunnel by automobile. The trip was made by Fred D. Pyle, of the United States Reclamation Engineers, and its object was to inspect the work on the automatic gages in the tunnel. Ordinarily this work takes up an entire day, and entails a long hike with ladders and blue-prints galore.

In the automobile all the tediousness of the trip was eliminated. The car was lowered into the tunnel, and although the weather was sloppy the trip was made in sixty-five minutes notwithstanding engine trouble due to splashing water and dampness. It demonstrated the practicability of using the automobile for inspection work and for transportation of supplies to gate tenders.

The machine was turned without leaving the tunnel, so that a twelve-mile run was made under the mountain.



Steel ribbons are woven across the width of the glove



This automobile made a twelve-mile inspection round trip through the Gunnison Tunnel and back in sloppy weather without mishap

Air Scouts Learn to Sketch Battlefields

Instruction in making drawings which will show accurately the enemy's positions, is given to every air scout



© Underwood and Underwood

A class of airplane observers making sketches of an enemy's battlefield of sand and sticks. Each man imagines himself to be flying a thousand feet above the battlefield in an airplane

IMAGINE yourself flying in an airplane a thousand feet over a battlefield, with instructions to make a drawing of what you see. You have but a minute or two to make your drawing, yet you must sketch in the enemy's gun positions, his lines of trenches, his transport roads, and all details of military significance. Your sketch must be accurate, otherwise your batteries would waste valuable ammunition in shelling the enemy's positions and perhaps the plans for an entire offensive would be upset.

That, in brief, is one of the important duties of an airplane scout. To do this work faithfully and accurately the airplane observer must undergo a course of theoretic-

cal and practical study. Before he takes his first flight he must be able to make sketches of improvised battlefields, one of which is shown in the accompanying illustration.

The men in the picture are grouped about a make-believe battlefield of sand and sticks. Each man, in making his sketch, imagines himself to be a thousand feet or more in the air. His camp stool is his airplane and his pad his sketch sheet. If he fails to make an accurate sketch of the field below him, he is considered to be deficient in his ability to observe. It is seldom that he has a second chance to sketch the same field, for the sand and sticks are changed continually.

Those of us interested in science, engineering, invention form a kind of guild. We should help one another. The editor of *The POPULAR SCIENCE MONTHLY* is willing to answer questions.

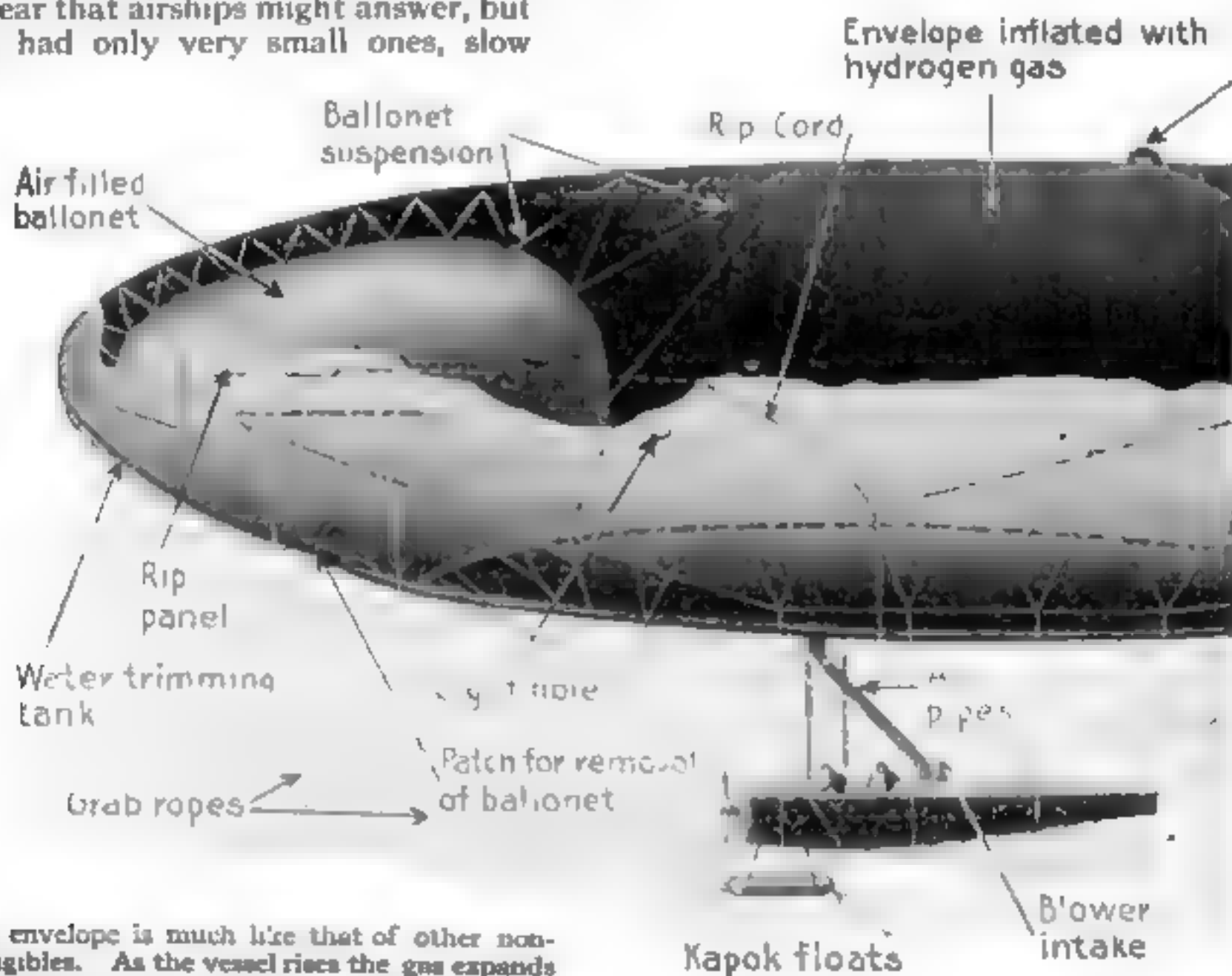
Our First Scouting Dirigibles

We have copied the British "Blimps."
Here the construction is explained

WHEN German submarines began to render even the high seas dangerous to shipping, England found herself in a very perilous position. To patrol the waters around England by small craft was the immediate remedy adopted. But the area to be covered was so vast that literally thousands of vessels would have been required. Airplanes were out of the question because they lacked the necessary endurance and because of the demands made on the pilot. It was clear that airships might answer, but England had only very small ones, slow

flying and very unhandy for the purpose.

Some unknown genius hit upon the "Blimp" as a solution of the problem. England was building airplane bodies, or fuselages, as they are called, by the thousands—building them as we build automobiles in this country. She was also producing hundreds of gas envelopes. Why not suspend an airplane fuselage from a gasbag? The question was brilliantly answered by the "Blimp."



The gas envelope is much like that of other non-rigid dirigibles. As the vessel rises the gas expands and some of it escapes through a safety valve to prevent bursting. To preserve the shape when the gas contracts, ballonets are used, one in front and one in the rear, as explained on next page

The Forty-Five-Mile-An-Hour "Blimp" Which Was Considered a Makeshift in the

The gasbag is 160 feet long and 31 1/4 feet in diameter, with a capacity of 77,000 cubic feet of gas. There is a standard 100-HP motor provided with duplicate controls so that the two passengers can run the ship alternately. Wheels are not needed under the car or

fuselage. Even with more load than the gas can lift the vessel can be made to rise easily without a preliminary run on the ground, simply by pointing the nose up (through air trimming) and letting the propeller exert an upward thrust. The chief difficulty with all

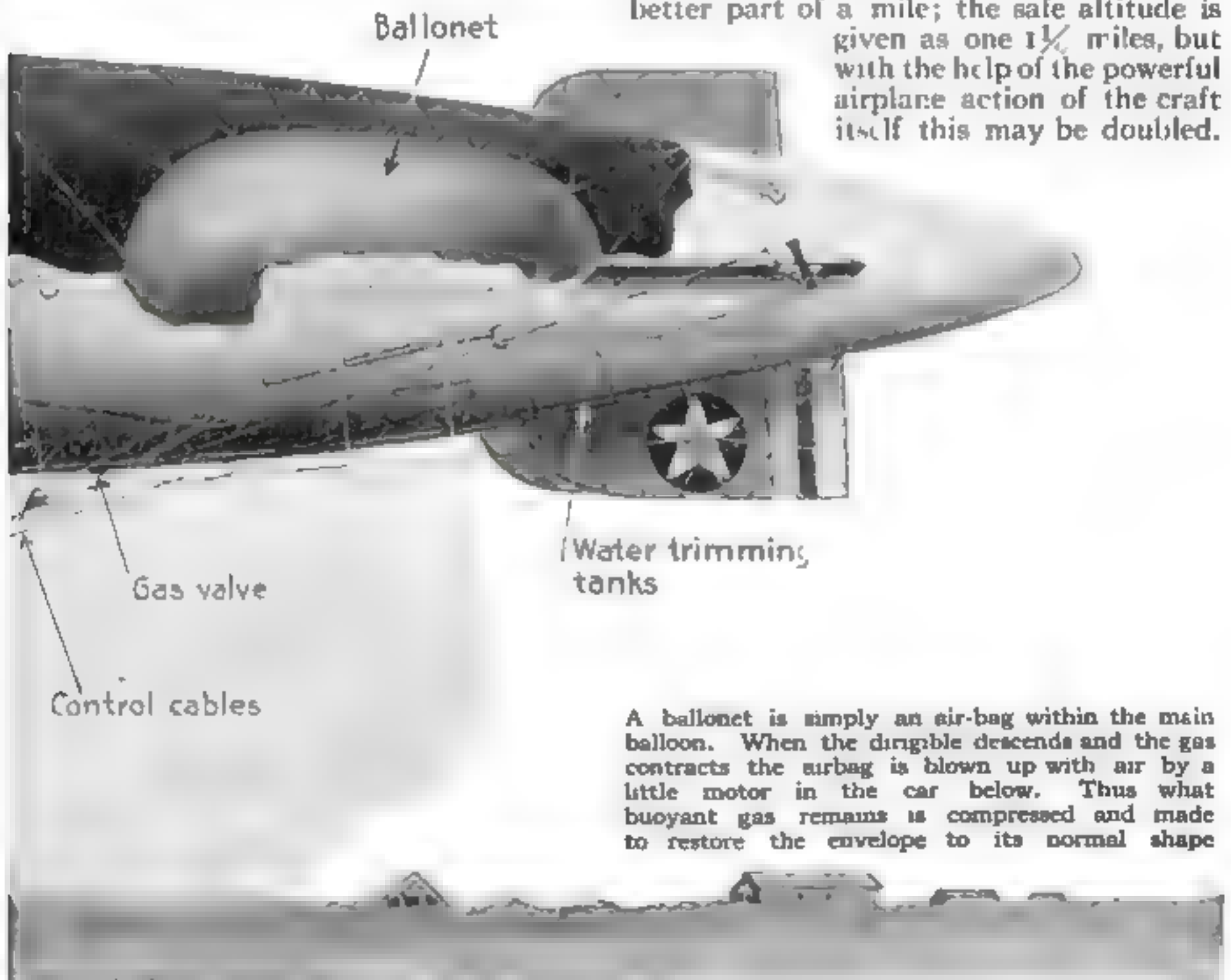
So little trouble was taken to adapt the airplane fuselage to the gas envelope that not even a motor-driven blower was provided for the airbag in the first Blimps. Part of the airplane propeller's slipstream, caught in a hose, sufficed.

The hybrid "Blimp" has shown itself incredibly superior to anything in its own class. It has a speed of forty-five miles an hour and a radius of action of several hundred miles. Its lift control approaches the seventy-mile-an-hour Zeppelin's, because the "Blimp's" surface is relatively greater, compared with its weight, than a Zeppelin's. Moreover, for the same speed the dirigible with a greater relative surface has more grip on the air in rising or descending by reason of the airplane effect of its gasbag than if it had a surface smaller in proportion to its weight.

Pressure relief valve

The United States has also built "Blimps." The main original features of the American "Blimps" is the addition of a blower driven by a cycle-motor and of a second airbag or ballonnet with valves to shift the air at will from bag to bag.

As a result, the ship can be "trimmed" (that is, its flotation forward and aft can be varied at will by driving the gas where there is less air) even while it is at rest and the elevator or vertical rudder is powerless. The blast of the propeller will probably be used to inflate the ballonets, that being safer than a separate motor. There has been added an efficient device for anchoring the vessel safely in a storm. The equivalent of life belts, in the form of kapok buoys are fastened above the airplane's floats. Hence the entire craft can rest lightly on the water, supported by its gas. Enough water and sand ballast are carried to permit the craft to rise the better part of a mile; the safe altitude is given as one $1\frac{1}{4}$ miles, but with the help of the powerful airplane action of the craft itself this may be doubled.



A ballonnet is simply an air-bag within the main balloon. When the dirigible descends and the gas contracts the airbag is blown up with air by a little motor in the car below. Thus what buoyant gas remains is compressed and made to restore the envelope to its normal shape

Beginning Has Proved a Brilliant Invention And a Real Innovation in Dirigibles

dirigibles is the erratic changing of the lifting force of the hydrogen gas with which they are inflated. Whenever the sun disappears, the gas cools and shrinks. When the vessel enters a cold stratum of air the gas shrinks, to expand again upon reaching a warmer

layer. But even the old slow dirigibles could add or subtract much weight to or from their lift by reason of their airplane action. As this action increases proportionately with the square of the speed the fast dirigible of today compensates easily for such variations

Potted Plants as a Part of a Plumber's Equipment

IT often happens that plumbers are compelled to tear up sidewalks and streets, and otherwise muss things up in making repairs or pipe connections. Usually they are little concerned about the appearance of the street during the repairing process. But R. H. Slayton, of Los Angeles, California, is an artist at heart although a plumbing contractor by trade. When he is compelled to tear up a street he puts a barricade of growing plants around the spot. This not only serves to shut off the sight of the piled-up dirt but diverts traffic.



These potted plants say with a graceful nod: "Go the other way. Repairs are in progress here"

Delivering Tires by Motor-Truck from Akron to Boston

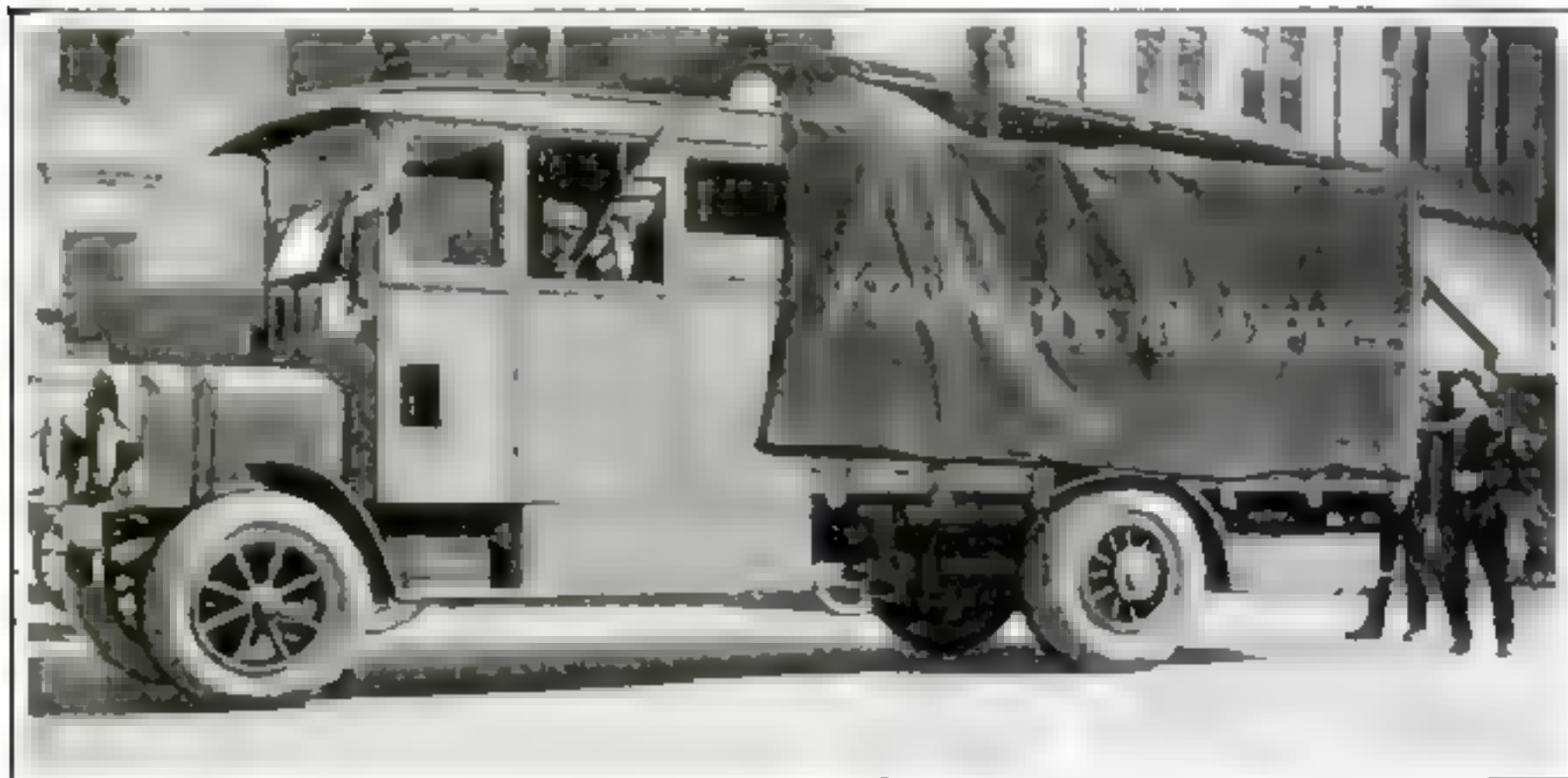
A NEW era in vehicular transportation has been inaugurated by one of the large tire companies of Akron, Ohio, which is now running a line of five-ton motor-

trucks between that city and Boston, Mass., a round trip distance of 1,540 miles. The truck runs on a regular railroad schedule, carrying completed tires from Akron and taking back cotton tire fabric from the company's cotton mills in Connecticut.

Three round trips have just been completed, the last in seven and one-half days. The truck used is a regular five-ton model. It is equipped with a special body having a closed-in driver's cab with a sleeping compartment directly behind it and extending clear across the frame from one side to the other.

This is used for sleeping quarters by the two drivers, who work in relays.

It might be supposed that sleeping on a motor truck would be difficult and very uncomfortable, but the giant pneumatic tires provide a wonderful cushioning effect that makes the truck ride almost as comfortably as a passenger car. The truck load is carried in a stake body aft of the cab and is covered with canvas to protect the goods in inclement weather.



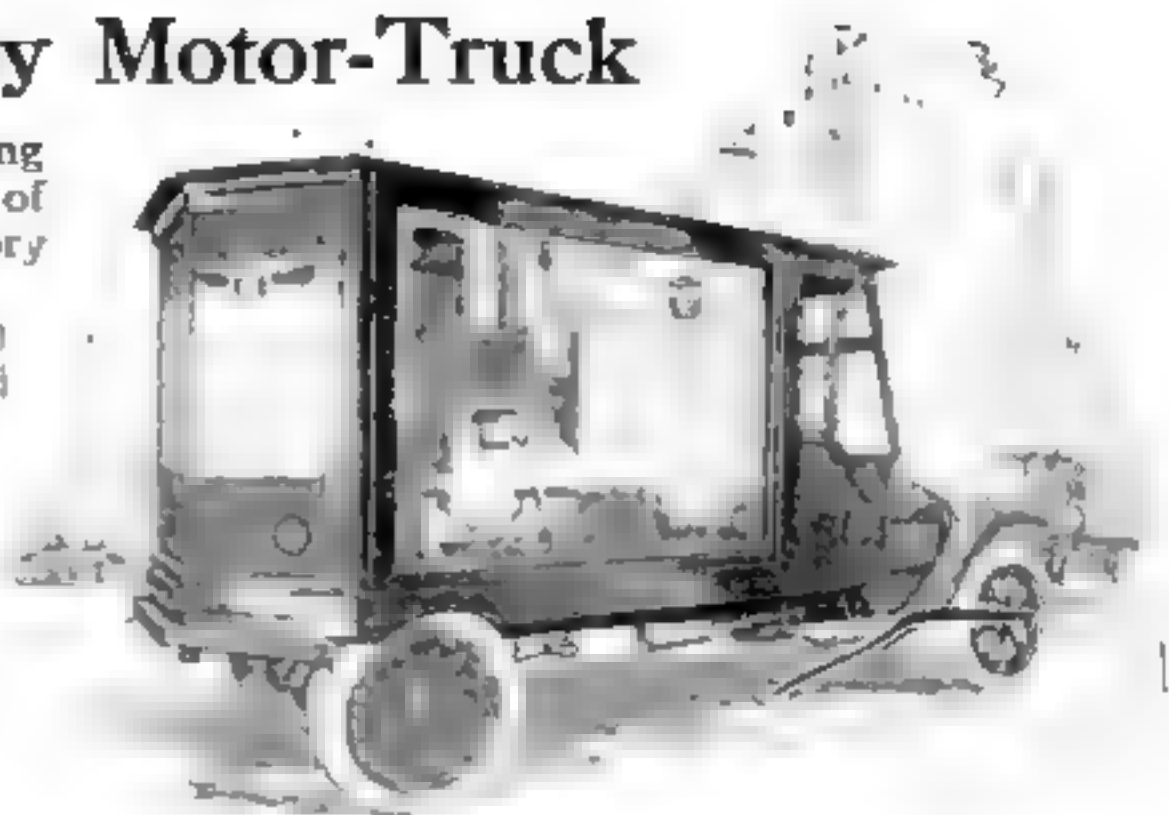
One of the five-ton motor trucks now running regularly between Akron, Ohio, and Boston, Mass., carrying completed tires from Akron and taking back cotton tire fabrics from the company's mills

Advertising By Motor-Truck

Traveling curtains, like moving pictures, attract the attention of the passerby to the continuous story

THE very latest mode of advertising is a glass-sided and ended motor truck from which are flashed at fifteen-second intervals the advertisements of ten well-known products. The fleet of trucks run over the most crowded of New York streets from noon to midnight, each carrying its advertising message to the thousands of pedestrians instead of making them travel to the signs. Not only this, but the truck advertisements are almost at the level of the pedestrian's eyes. It is unnecessary to twist your neck into a serpentine knot to gaze heavenward at the latest forms of sky signs.

The truck advertisements are painted on transparent curtains which are hung within the body and which show through the glass sides by day as well as by night, for after dark they are illuminated by means of banks, or trays, of lights. Each curtain appears first on one side, then at the rear end and finally on the other side, the change from one advertisement to another being made when the interior illumination is automatically shut off temporarily. The appearance and disappear-



Plan of the Advertising Motor-Truck

Ten transparent curtains are arranged on guide rollers so that three are continually in view, one on each of the two sides and one on the end. The curtains are hung from a continuous steel cable which is made to travel over the grooved guides by means of a motor driven by current taken from a storage battery inside the truck body. The curtains are stopped automatically so that each is even with the glass during the fifteen-second stopping period while the truck is in motion. The storage battery furnishing the current for operating the curtain motor is continually being recharged through a special charging generator driven off the regular vehicle engine.

ance of the curtains are intended to arouse the curiosity and incite the interest of the pedestrian or vehicle passenger as to the nature of the next one to appear.

The arrangement of the curtains is such that the advertisement which is shown on one side of the truck body is carried immediately to the back and later on to the other side, so that although the person on the street sees a constantly changing surface, the same pictures serve over and over again. The curtains are hung on a continuous steel cable which is made to travel over the grooved guides by means of a motor driven by current taken from a storage battery carried inside the truck body.

This electric motor operates a vertical shaft by means of a system of gearing. The stopping period of each curtain and the moving time, when it is replaced by the one immediately following, depend upon the automatic action of a special cam device.

The storage battery which furnishes the current for the motor operating the curtain is continually recharged from a special charging generator driven off the regular vehicle engine.

At night especially the illuminated truck attracts attention.

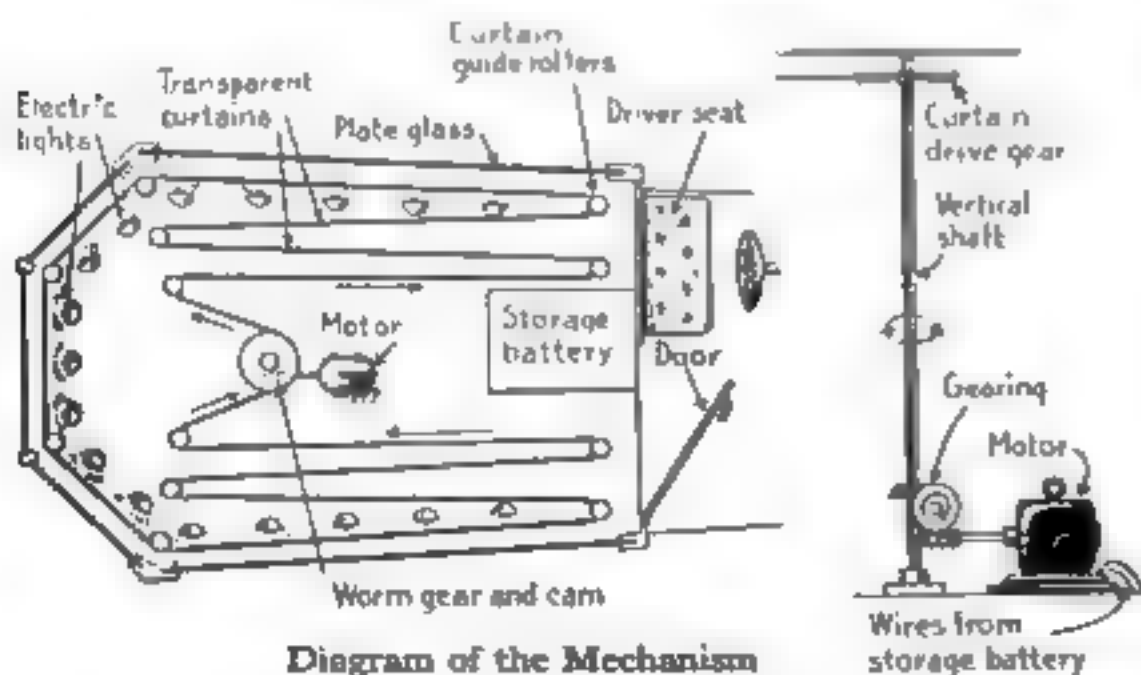


Diagram of the Mechanism

The arrows indicate the direction of the curtains each of which appears first on one side and then on the opposite side in rapid succession. The curtains are actuated by an electric motor which drives a vertical shaft by means of a system of gearing. The stopping period of each curtain and the moving time when each is replaced by the one following after is governed by a special cam device.

Photographing the Jolts of an Automobile

How you can tell what shock-absorber is most efficient



One of the Many Records Obtained

The two top lines are made by the lights worn by the passengers and show the jolts to which those in the front and rear seats were subjected; the lower four lines show the movement of the car when overriding

an obstruction. It is evident that the passenger in the rear seat is thrown up and down more violently than the passenger in the front seat, and that the passengers are tossed up more than the car itself

EVERY one of the hundred odd manufacturers of shock absorbers, tires, and springs claims that the application of his particular device to the automobile will give the greatest possible ease of riding. Now comes Mr. W. C. Keys, an experimental engineer, with a method of visibly recording the effect of jolts on a car and of ascertaining to what extent shocks are absorbed.

Electric lights are mounted on the front and rear hubs, the front and rear fenders and on the passengers. The lights are turned on, and the car is driven at night across the field of a camera.

The record obtained shows accurately the path of travel of every critical part of the

car as well as of the passengers. Study the photographic record which appears on this page. The two top lines are made by the lights worn by the passengers, the topmost line representing the passenger in the rear seat and the one immediately below it representing the passenger in the front seat. The other lines are made by lights fastened on the car.

The four lower and straighter lines represent the riding qualities of the springs and tires. The two top lines sum up the riding qualities of the car and show the effect of the passengers' position in relation to the axles, of the trimming of the seat cushions, of the flexibility of the frame, etc., in addition to the effect of the tires and of the



The Disposition of the Lights

Lights were attached to the car on the hubs, on the fenders, on the body, and on the passengers as here

shown. Beneath the car appears the obstruction which the car had to override in making the experiments

springs. It is evident that the passengers are tossed up and down for greater distances than the car itself when an obstruction is overridden.

The records seem to show that on the whole the passenger in the rear seat is better off than the man in the front seat. The man in front gets two jolts for each bump, first when the front wheels pass over the obstruction, and second, when the rear wheels pass over it.

On the other hand, it is evident that the passenger in the rear seat, represented by the top line, is jolted once only by the obstruction, the wave in the line showing the spring action. It is clear that the passenger in the rear seat is thrown up appreciably higher than the passenger in the front seat.

At last it becomes possible to analyze exactly the performances of different automobiles, or of the same automobile, with variations in such accessories as the leaf-springs, cushion-springs, inflation pressure of the tires, shock absorbers, stiffness of the frame, weight of the axles, etc. So that the unproved statements of the manufacturers need no longer be all that accompany such appliances.

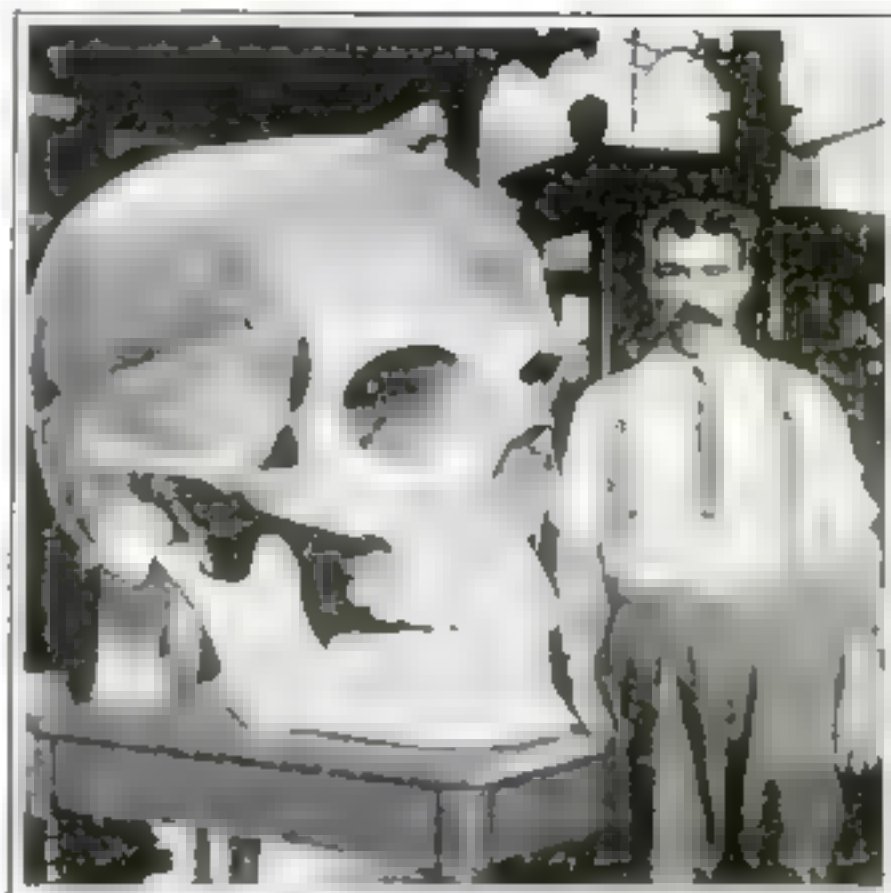
What's This? A Mosque? No, Just a Flagman's Shelter

A FLAGMAN'S shelter house, made up of old locomotive parts, guards a street crossing on the Southern Pacific at San José, Cal. The shelter was constructed by the consulting engineer from old engine wheels, springs, tires and other parts of discarded locomotives.

Besides being an oddity in appearance, it is solidly built and one of the most elaborate shelters for flagmen in the state. It is the curiosity of the locality.



Ah, yes, a little Mosque where pious Mohammedans may pray. San José knows better. It is a flagman's shelter made of old scrap



The skull is made of paper and was used by Army Medical Students for anatomical study

The Army Medical Museum's Giant Skull

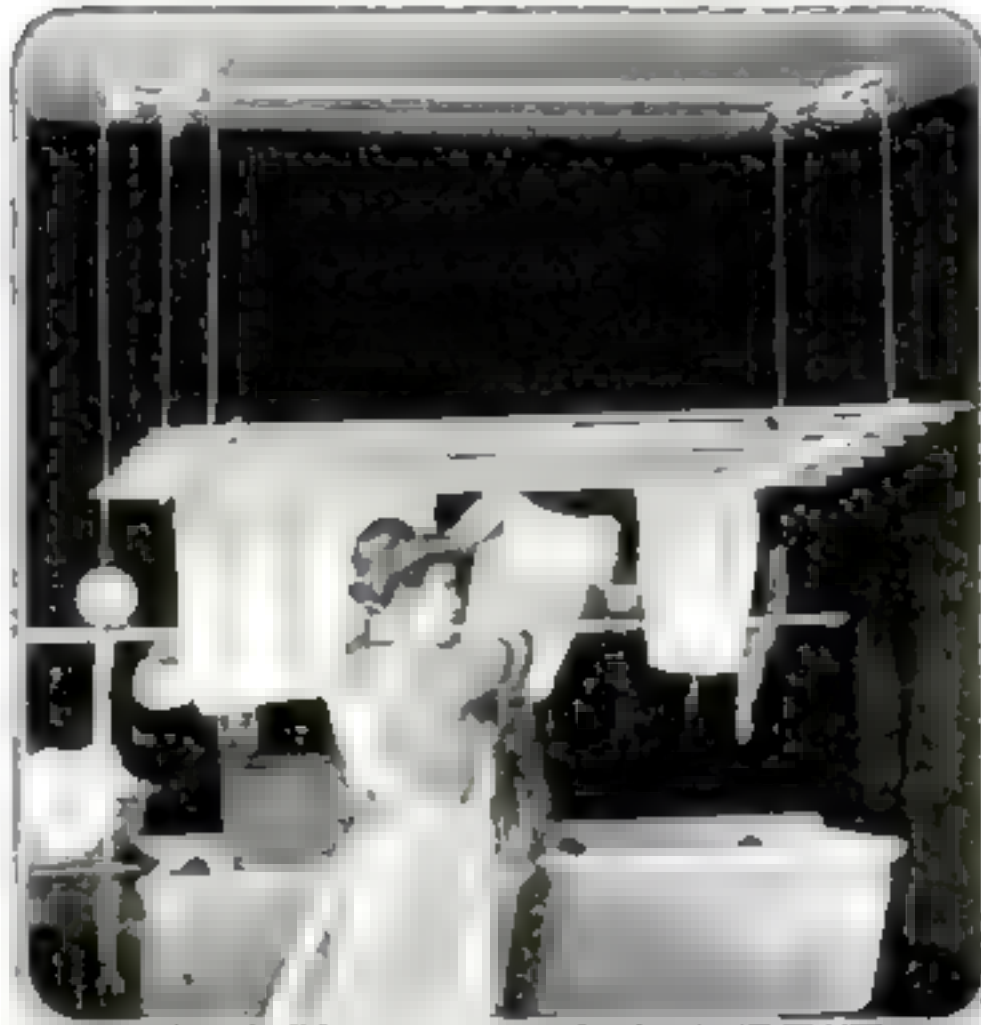
COMPARED with the man standing beside it, the huge skull shown in the accompanying photograph would appear to have belonged to a person about thirty feet high and to be reminiscent

of the times when "There were giants in those days." As a matter of fact, it is not a real skull, but a *papier mâché* representation of one, a little over four feet high. It stands in the Army Medical Museum at Washington, and was greatly exaggerated for purposes of anatomical study.

The skull is perfect in every detail. The students study not only the construction of the human skull but methods of trepanning and of mending all the different varieties of fractures. It is also used in instructing the classes in dental surgery.

Housekeeping Made Easy

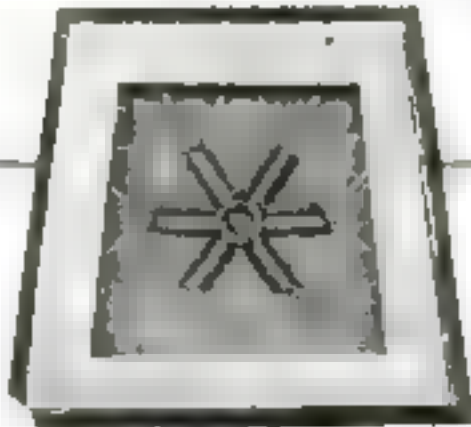
Below: A strip of lead ribbon about one inch wide, bent so that it will hold flowers upright in a shallow bowl filled with water. It is used for table decoration and is intended for small, short-stemmed cut flowers



Below: An egg poacher that takes care of two eggs at a time. A slide bottom makes it possible to lift the eggs out of the water and drop them directly on the prepared toast without spoiling their shape



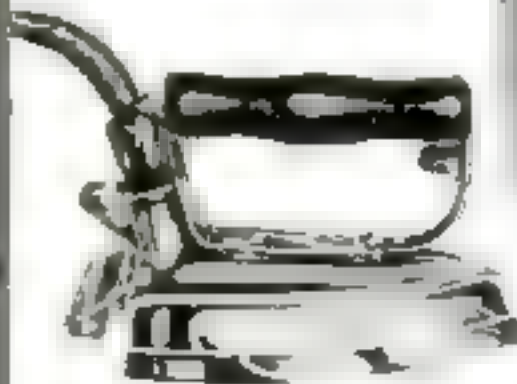
A convenient indoor clothes-dryer. It is suspended from the ceiling by ropes and pulleys so that it may be lowered to within easy reach and then drawn up again to the ceiling where the clothes are out of the way and where the warmest air is encountered



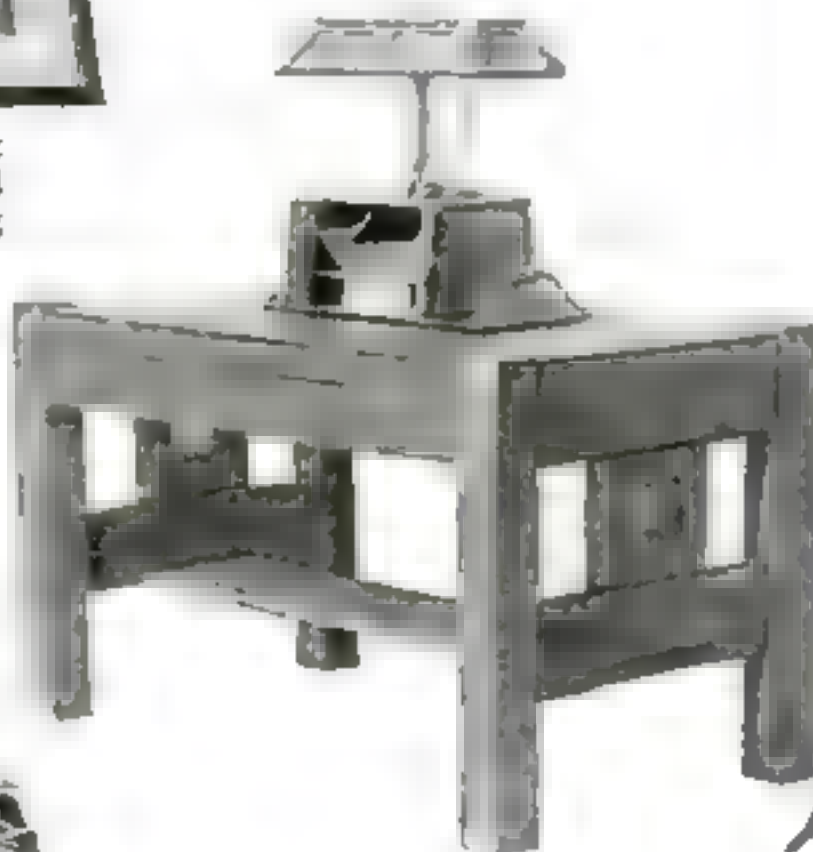
A chair seat with a cushioned coiled spring



This non-tilt picture hanger has three points of suspension



An electric iron with a hinge joint which keeps the pipe out of the way

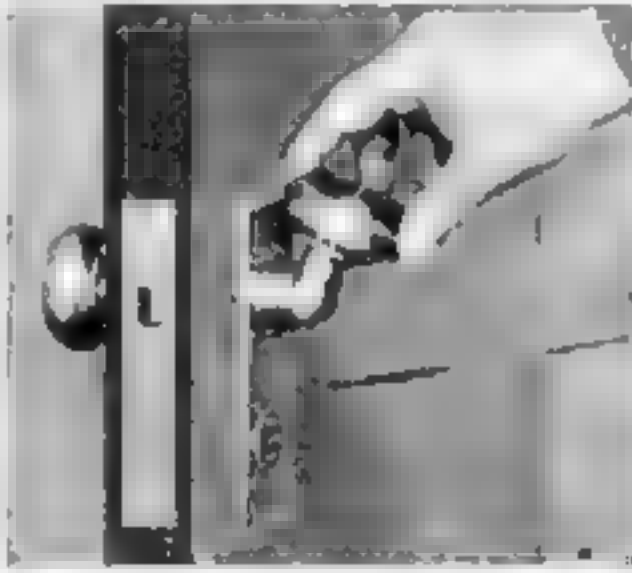


This electric student's lamp has a miniature cabinet as its base holding stationery, pens, stamps, etc.



A registering disk for the nickel-in-the-slot telephone. It checks the number and length of calls

Housekeeping Made Easy



By merely lifting this door knob in the manner shown, you lock the door, the key arrangement being integral with the knob and the brass door plate



With this arrangement you can have a drop light and a fan operated from the same socket

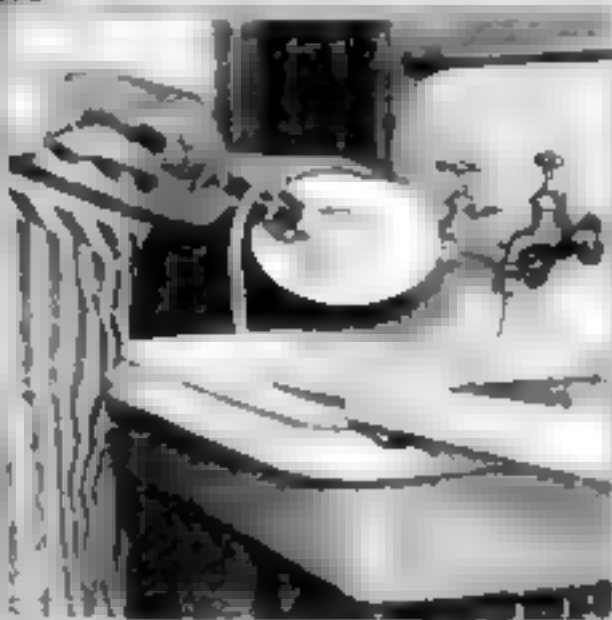


At last! A jar cap which can be removed without loss of time and temper. When the convex top is depressed the edge springs out from the glass shoulder

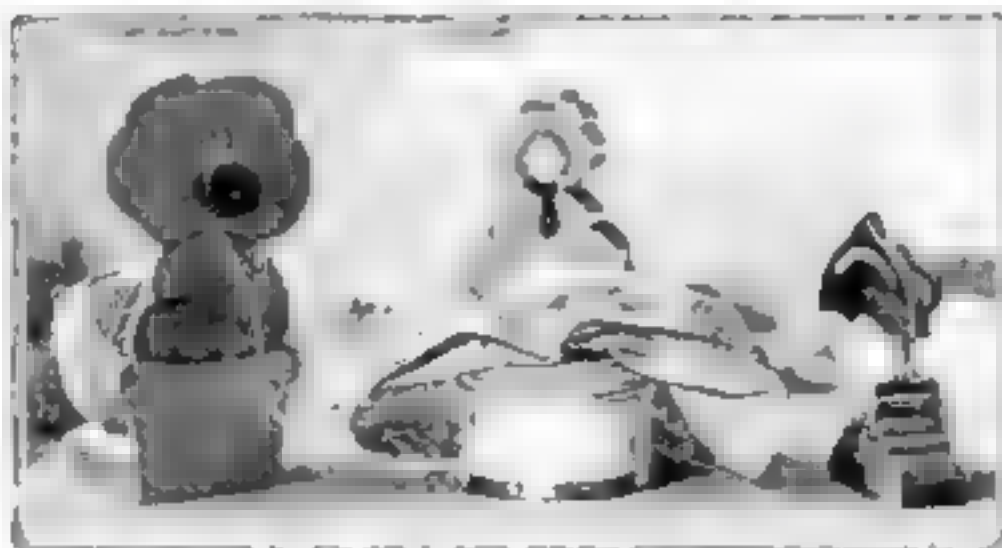


A cabinet for the small phonograph. It has the appearance of the high-priced machines. The phonograph may be taken out on the lawn or on picnics or to the summer camp, and returned to the cabinet for home use

Below—A mop for overwashing. It has a hose attachment to the faucet over sink



A mattress made up of three pads which may be used separately upon occasion, as when an unexpected guest must be made comfortable on a couch. The top pad may be taken out and left to air without any inconvenience



Utilities disguised as ornaments. Under the doll's draperies is the manure pot; beside her are a carved wood twine-holder and a holder for buttonhooks

Loading Trucks Without Disturbing Sidewalk Traffic

IN order to save many steps between their wagons and the loading platform, the truckmen have a habit of backing their vehicles against the shipping platform or against the curb-stone and spanning the intervening sidewalk with a board or chute.

The result in either case is that you and all the other pedestrians, finding your path blocked, must leave the sidewalk and either walk out into the gutter and around the truck and horses, or climb up a few steps to the level of the loading platform and down a few steps on the other side. All of which saves steps and much hard work for the truckmen, but makes the lot of the pedestrian unhappy.

Someone who is evidently thoughtful has recently devised a loading chute which is now being used by a New York city firm. This chute, as will be noted in the accompanying illustration, is supported by a form of tripod at a distance above the sidewalk sufficient to clear the tallest pedestrian, who can pass under it without discomfort of any kind. Meanwhile the chute, having a sufficient slant, allows for cases to be placed at one end and slid down by the force of gravity to the truckmen ready to receive them.

The tripod is hinged to the chute, so that it may be folded against it for the sake of compactness. This is an important feature, since the chute is not a permanent structure but is erected only at such times as the trucks are loading or unloading.



The cases are placed on the chute and slide down by gravity to the men on the waiting truck

Even a Battleship Would Sink If It Were Not Cleaned

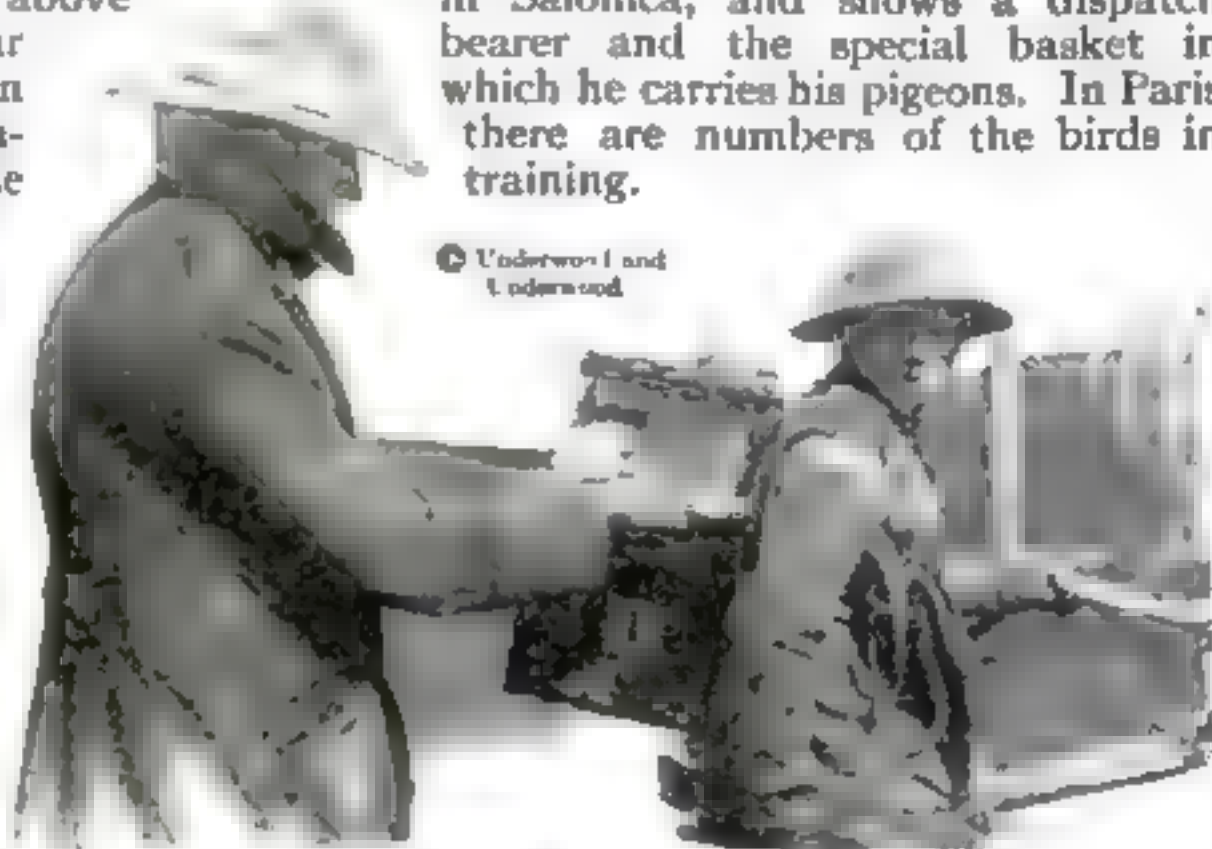
ONE of our big warships was brought into dock the other day for a cleaning. Two hundred men worked all day scraping off six hundred tons of animal and plant growth from its sides and bottom. This

tremendous quantity of sea life had accumulated in less than two years, during which time the ship had traveled many thousand miles. The weight of the barnacles was so great that from twenty-five to forty per cent extra coal was consumed in maintaining the vessel's speed.

The Carrier Pigeon Still Holds Its Own as Trusted Messenger

DESPITE the convenience of the telegraph and wireless, carrier pigeons are still used to a great extent in sections of the war zones where the telegraph and wireless are not available.

The accompanying photograph was made in Salonica, and shows a dispatch bearer and the special basket in which he carries his pigeons. In Paris there are numbers of the birds in training.



A dispatch bearer and his pigeon, which he carries in a special basket to the place from which the bird is sent

Shoot or Stab This Dummy, and You'll Be Blown Up

BOOBY traps," as the British call them, are dummy soldiers containing a large amount of high explosive. They are death traps set by the Germans for their enemies. Scientifically and painstakingly constructed, the dummy shown would have blown to pieces anyone who touched it. Fortunately the British "smelled a rat." They would not touch it. Careful investigation proved that it was nothing more than a cleverly-contrived bomb.

A description of the dummy which reached this country does not contain an explanation of how it could have been exploded. The British reports have not described its internal organism. Conjectures are many. Some believe that a fall resulting from the slightest jolt would have caused the explosion.

The By-Products of the Grapefruit Obtained from the Culls

WHEN the fruit-grower has marketed his finest and best specimens of grapefruit there are likely to remain many inferior specimens which would be wasted unless utilized to obtain the by-products.

These by-products have been found to be numerous. Citric acid is obtained in great quantities from the culls, especially from the early winter fruit. Sugar is obtained at the rate of about 4.4 per cent in the early winter fruit and 8.5 per cent in the spring fruit. The peel yields about 2.1 per cent of recoverable oil. A good yield of pectin is also obtained from the skins. This is a grayish-yellow flaky mass resembling sugar in



The death trap left by the Germans in a locality they were compelled to evacuate. The figure contained high explosives

appearance which stiffens on standing in water to a clear, tasteless jelly and is used as the basis of many kinds of fruit desserts.

YOU NEED BOOKS IF YOU WANT TO SUCCEED

You can't get on in the world unless you read—read the books which will make you more valuable to those for whom you work. You don't have to go to college. Edison never went to college. But he has probably the finest library of technical books in this country. If you want helpful, practical books on any subject, write for **POPULAR SCIENCE MONTHLY'S** new **BOOK CATALOGUE**. The books described in it have been carefully selected by experts. Write today for the new book catalogue. It's free.

Popular Science Monthly, 239 Fourth Avenue, New York City.

One-Piece Ships of Stone

Already a company has been formed and financed to design and build concrete ships of 4,500-ton capacity

By Joseph Brinker



Broadside view of 550-ton concrete barge used by Arundel Sand and Gravel Company of Baltimore, Md. This picture was taken just before the barge was launched. The barge has been in use for several years

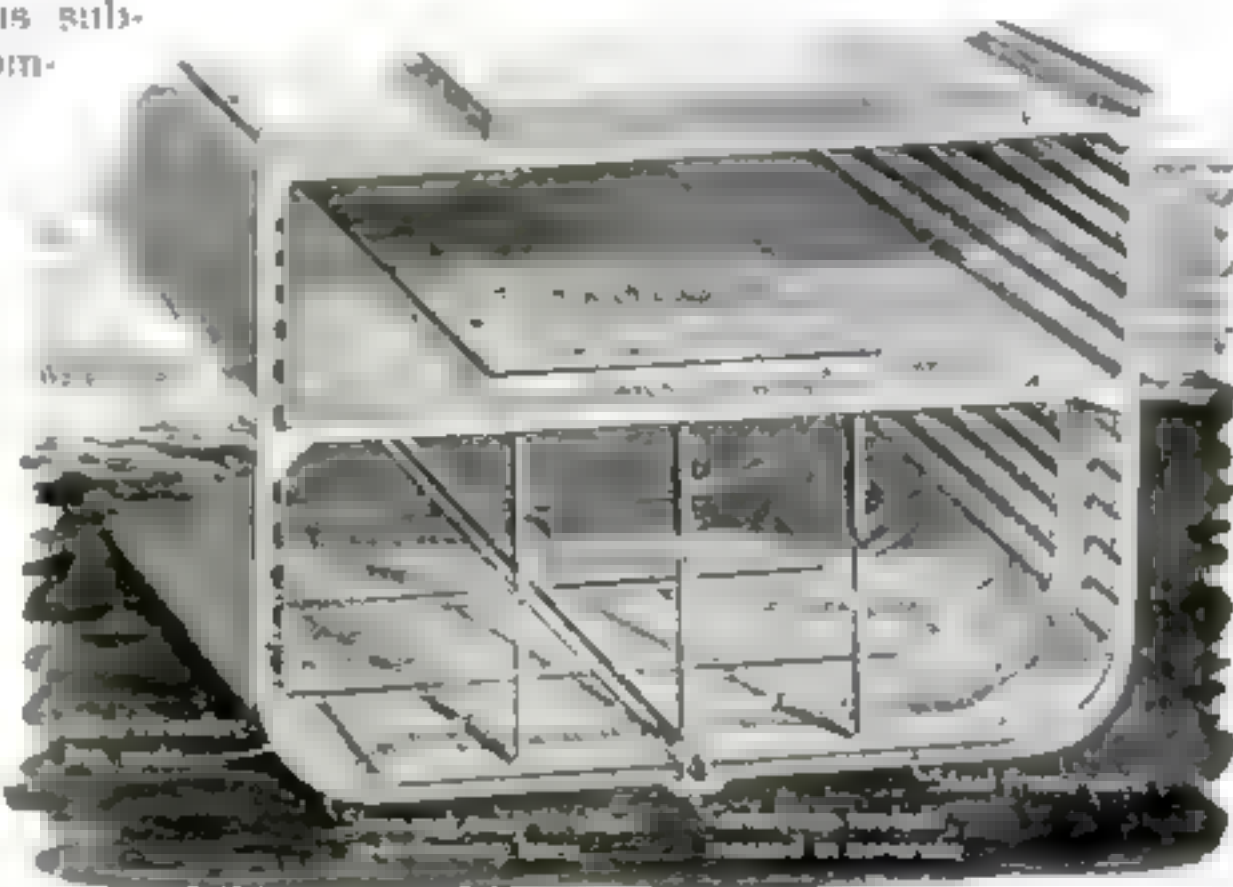
CONCRETE ships are possibilities. They may be built in addition to steel and wood vessels to offset the acute submarine peril. According to authorities, the German U-boats are sinking Allied and neutral tonnage much faster than it can be renewed. This cannot go on. If it does, we shall lose the war. Even our Government-controlled shipbuilding program for steel and wooden ships will not produce sufficient tonnage to offset the present U-boat toll unless this tonnage is greatly increased by the use of some new substance

Concrete seems to be this substance. Already a large company has been formed and financed in San Francisco to design and build sea-going vessels of 4,500-ton capacity to be made of reinforced concrete. Plans now drawn up show these vessels to be three-hundred feet long, with a beam of forty-six feet and a draft of twenty-four feet. The concrete hull is to be six inches thick and the steel re-enforcing rods are to be welded together to reduce the quantity of steel required to a minimum by avoiding the waste from laps and bolting otherwise necessary.

It has been calculated that the steel re-enforcing for the vessel will weigh less than the bolts needed in a

wood ship and that the completed hull will weigh less than that of a wood boat of the same carrying capacity. Allan McDonald, the designer of the ship, estimates that it can be built in ninety days and that turbine engines of two thousand five-hundred horsepower will be sufficient to drive her at a speed of fourteen knots, which is considered enough to enable a boat to escape a submarine under ordinary conditions.

There is no question about the availability of the concreting materials and that



The Mid-Ship Section of a Concrete Boat

It would be made up of light steel framework with wire re-enforcing on the sides. The concrete covering is shot into place by compressed air. The bottom of the vessel is cast in forms in the usual way. Poured concrete has much less density than that shot into place and is liable to be more porous than the kind placed under pressure. A slice is shown cut out of the boat from lower deck to lower deck in order to indicate the position of the steel re-enforcing rods placed longitudinally through the framework

the use of artificial stone opens up a new avenue to the increased production of ships. Even with plans drawn, however, the actual building of such a large concrete vessel and its practicability after it is built, are entirely different matters. While every one knows of concrete's adaptability to almost any form because it is handled in a plastic or semi-fluid state; of its fire-proofness; of its general use in large office buildings, in private residences, in bridges, docks, sidewalks and in practically all branches of construction, there is yet much to be done by naval architects and marine engineers before the five-thousand-ton concrete sea-going vessel is a practical, commercial certainty. This does not mean that such a ship is an impossibility but that American ingenuity

and enterprise must be brought to bear and problems peculiar to concrete construction solved.

The Concrete Vessel Is Not New in Shipbuilding

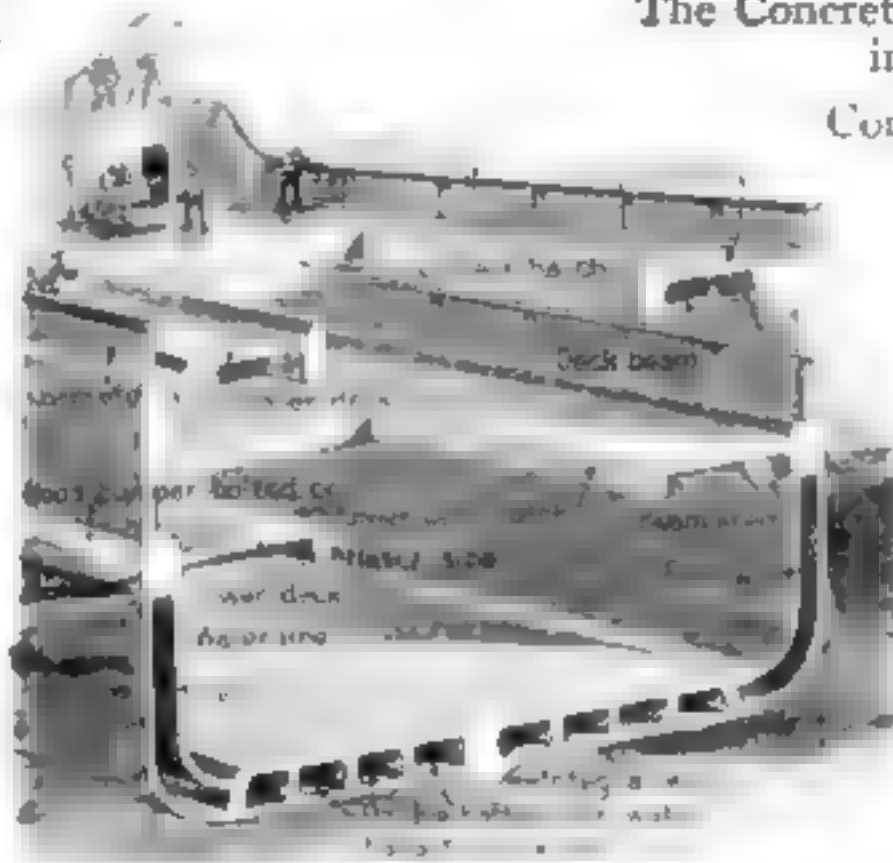
Concrete vessels have been built in the past. But they have been small barges or the like for inland water work, with but one or two exceptions. One of these is a three-thousand-ton concrete vessel now under course of construction in Moss, Norway. She is expected to be delivered to her owners by the time this article appears in print.

The first concrete boat really dates back to 1849, when M. Lamhot, of Carcass, France, built a small ten-

foot rowboat of re-enforced concrete.

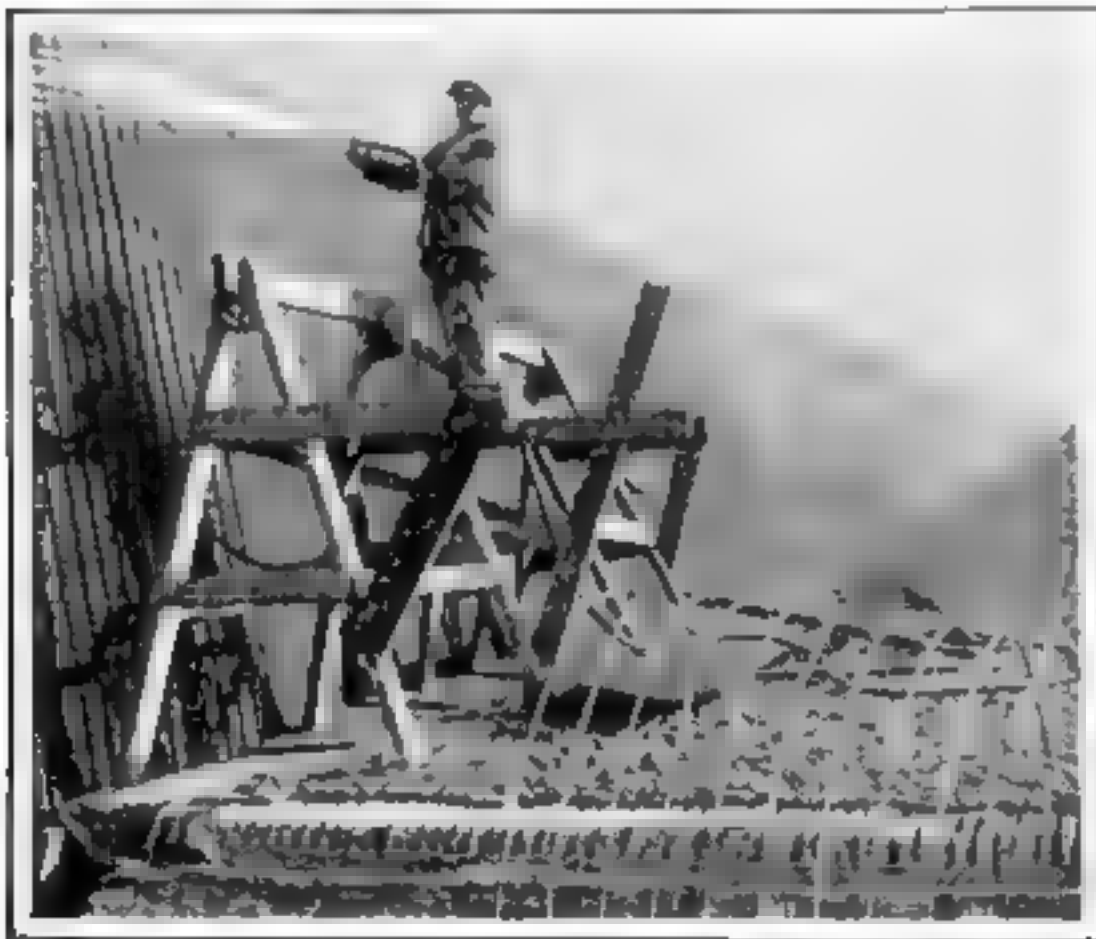
While the boat and its method of construction were investigated by the French Government, the vessel was evidently far in advance of its time, and its further development was left in private hands.

Almost fifty years later, or in 1899, Carlo Gabellini, of Rome, Italy, built several concrete scows and barges, one of the latter a one-hundred-fifty-ton vessel for the city of Civita Vecchia. Meantime, small eleven-ton concrete barges had been built in Holland in 1887, and later, a two-hundred-twenty-ton freight barge in 1909 by German shipbuilders at Frankfort-on-the-Main. In 1910 a similar concrete barge was built for use on the Welland Canal, Canada, while in 1911, barges or pontoons made of concrete were successfully built and employed in work at the Panama Canal. In 1912, Oscar F. Lackey, then harbor engineer of Baltimore, Md., built several five-hundred-ton barges, one of



A Typical Concrete Cargo Boat

It has two decks, a double bottom for ballast or fuel, and a double hull between the lower deck and the double bottom. This gives greater strength. The well known principles of concrete building construction are indicated in the form of the hull members and the method of distribution of the steel reinforcing



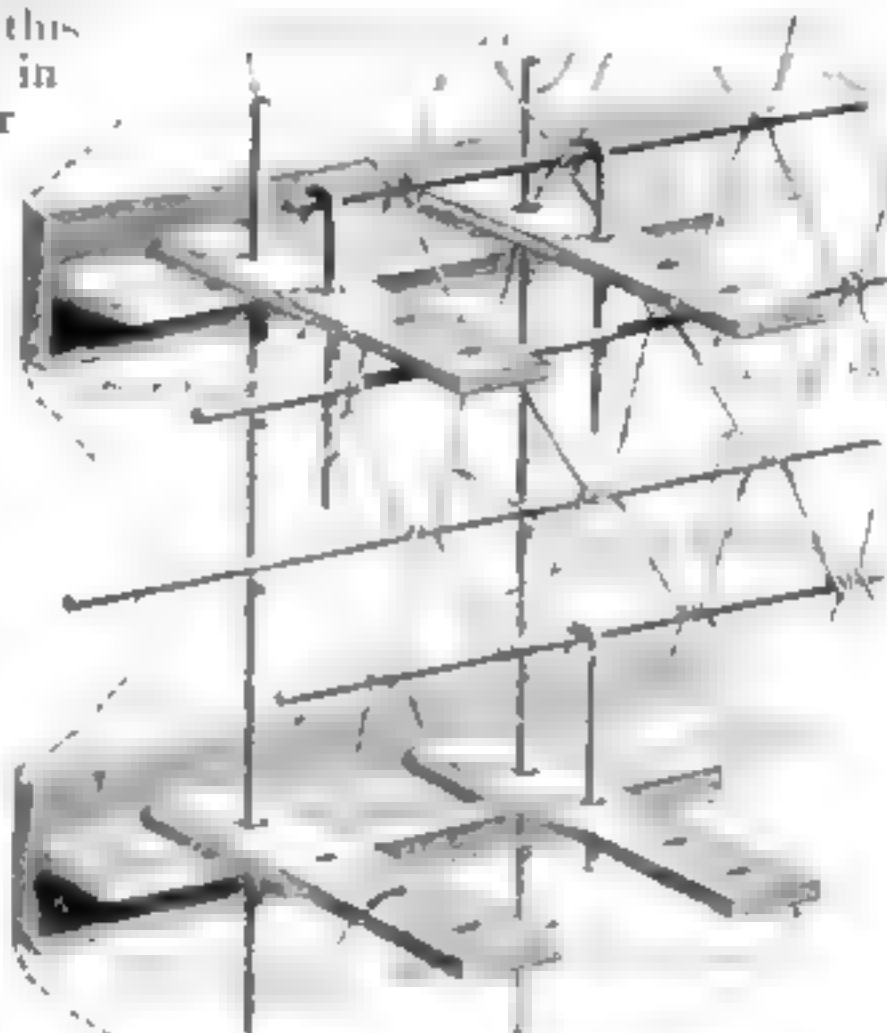
How the Concrete Hull Will Be Made

Imagine this man standing on the scaffolding alongside a ship, and you will get an idea of how the three layers of the hull are shot into place by compressed air. The man shown here is building up a somewhat similar concrete slab on metal lathing to form the outer wall of a sewerage disposal plant. The cement is shot through a hose

which is shown in the illustration on page 556 of this issue. This has been in use for more than four years and is still giving satisfactory service.

Advantages of Concrete Ships

Re-enforced concrete barges seem to have given good service, so that the present problem of building self-propelled ships of four- or five-thousand tons capacity is one of construction methods and of taking care of the severe strains of ocean travel and the vibration of the engines. These conditions met, concrete has many advantages not enjoyed by either wood or steel. Concrete ships would be fireproof and would require less maintenance than steel vessels because of the elimination of scraping and painting to avoid deterioration due to rusting. Also, their bottoms would need to be cleaned less often because sea growths do not attach themselves so readily to concrete as to steel and wood. Some advocates of the concrete vessel claim that it can be built at less cost than a ship of steel or wood, that it has a

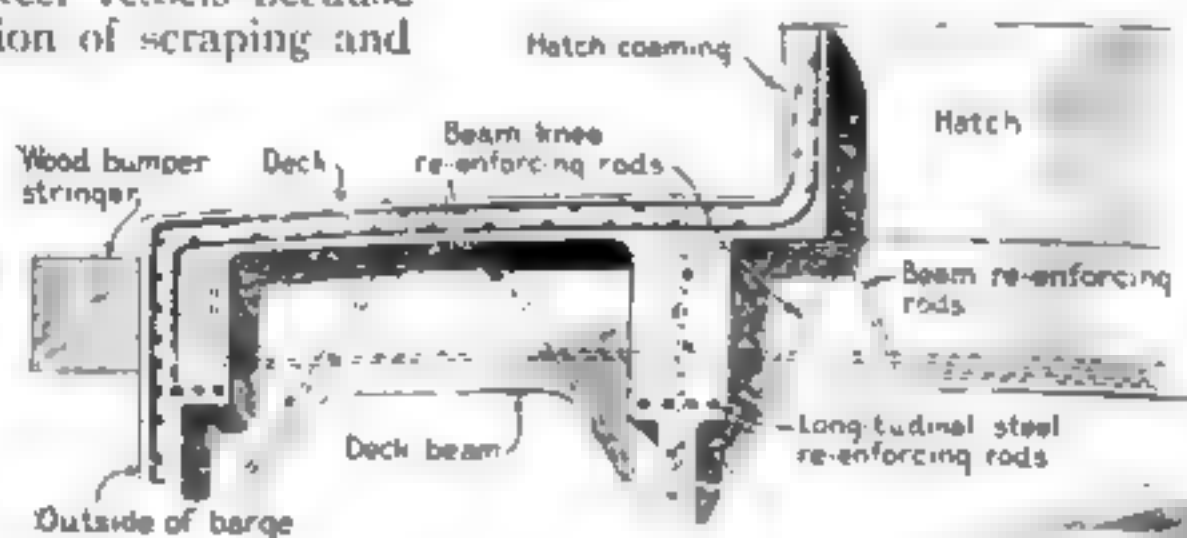


The Cement-Gun Rod Re-enforcement

The T-bar used in the side of the concrete ship are made by shooting the material into place. The spacer bars have holes through which are inserted short rods with hooks to carry the horizontal bars on which the three layers of re-enforcing wires are hung. By this means the wire is kept always in its proper relation

longer life than either and that less skilled labor is required. While this may be true in the case of small barges and the like on which actual cost figures are available, it remains to be proved in the case of the large ocean-going freighter. The standardized cargo boat of either steel or wood as planned by our Shipping Board will be built in much less time than any other ships constructed heretofore.

Following previous re-enforced concrete construction methods, the proposed concrete vessels may be built along two general lines—one by the use of forms, as in most building work, and the other by the

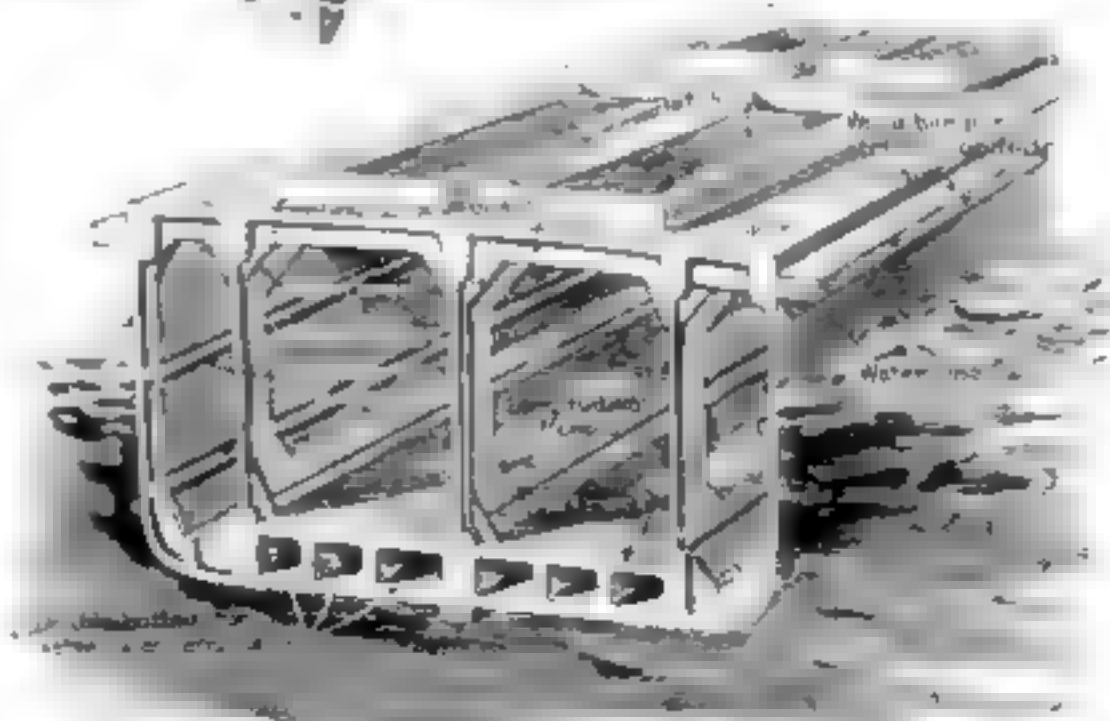


Transverse Section Through Deck and Part of Hatch

Above we have a good illustration of the manner in which the construction of the concrete boats will follow the usual methods of concrete building in regard to re-enforcing. Note the wood bumper stringer bolted to the concrete hull to ward off collisions, which might tend to crack the concrete and cause a leak

A Simple Concrete Barge

Below Note the single side hull and double bottom construction, and the form of the three vertical deck supports and the beams



it has a

plastering-like method in which a very dense but fluid mixture of cement is shot into place by means of compressed air. The former type is the most common and may be made with or without double-bottoms, or with single or dual hulls separated by an air space which may or may not be employed to carry fuel or water ballast. Both types of construction are shown in the accompanying perspective and detailed sketches.

How the Ships Will Be Built

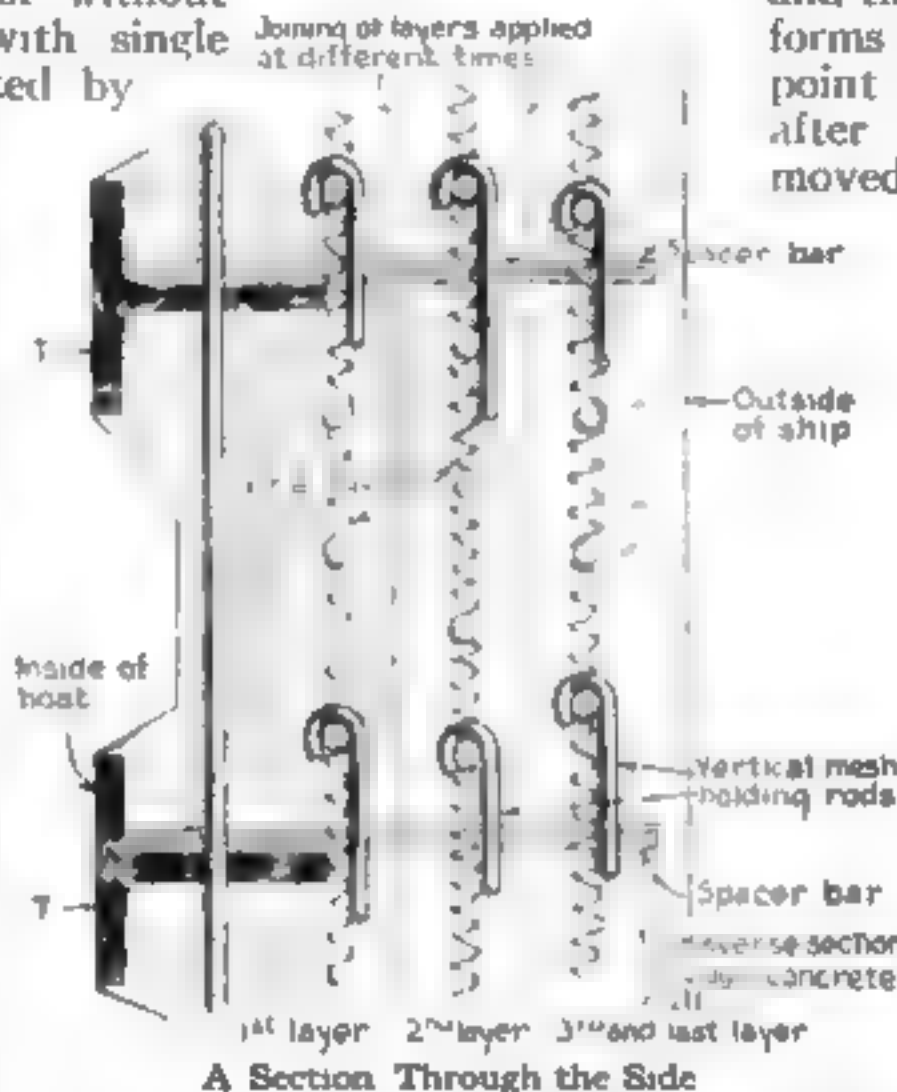
The method by which the concrete is shot into place by means of compressed air as advocated by Carl Weber, a concrete engineer of Chicago, is really an adaptation of the "cement gun" process previously described in the POPULAR SCIENCE MONTHLY. This method makes use of a light steel framework for the vessel. To this framework are attached a series of re-enforcing rods carrying wire mesh or other flexible re-enforcing, each of which is in turn covered by thin layers of concrete forced against one another in the applying so that the whole is a homogeneous mass of such a nature that the line of joining one layer with the next cannot be detected if the slab is cut across. The details of all of these methods are shown in the accompanying illustrations.

The great advantage of the compressed-air method of shooting the concrete into place, is that it eliminates almost one-half of the wood or steel forms necessary if the ordinary pouring method is pursued. This

is an important advantage because of the first cost of the forms; their difficulty of construction due to the unusual shapes at the extreme front and rear ends of the vessel and the cost of setting up the forms and moving them from point to point on the vessel after they have been removed from sections already poured and hardened.

The advocates of the pouring method have planned to overcome the difficulty and cost of moving the forms by devising a cheap, steel framework both inside and outside of the vessel along which the forms may be pushed without lowering them to the ground.

Unusual-shaped forms for the forward and rear ends of the vessel may be provided by the use of collapsible steel forms such as are used in bridge culvert work.



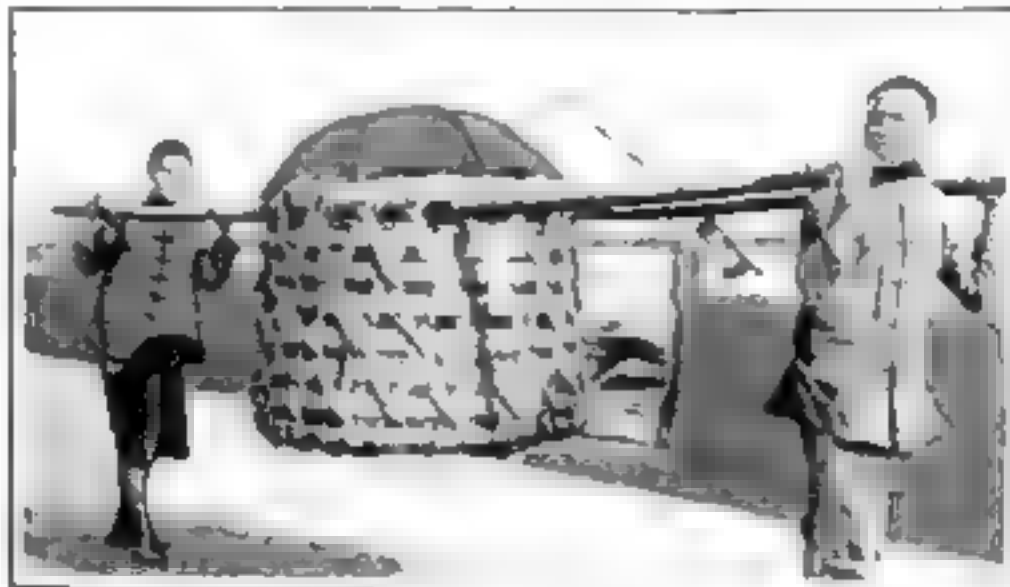
A Section Through the Side
The T-irons, spacer bars, hooked rods and wire mesh of a shot-into-place concrete boat are shown. The three vertical lines between the ragged lines indicating the wire mesh show roughly the thickness of each layer

Clang! Clang! Make Way for the Chinese Ambulance

ONE of the reasons why the people of the Occident are generally disposed to agree with Bret Hart that "the heathen Chinese is peculiar" is the unusual method of the Chinese in handling the sick. Notice the ambulance in the photograph, in which a dying man is being transported. It is of wicker basketry of the same type as

that used for conveying pigs and poultry to market.

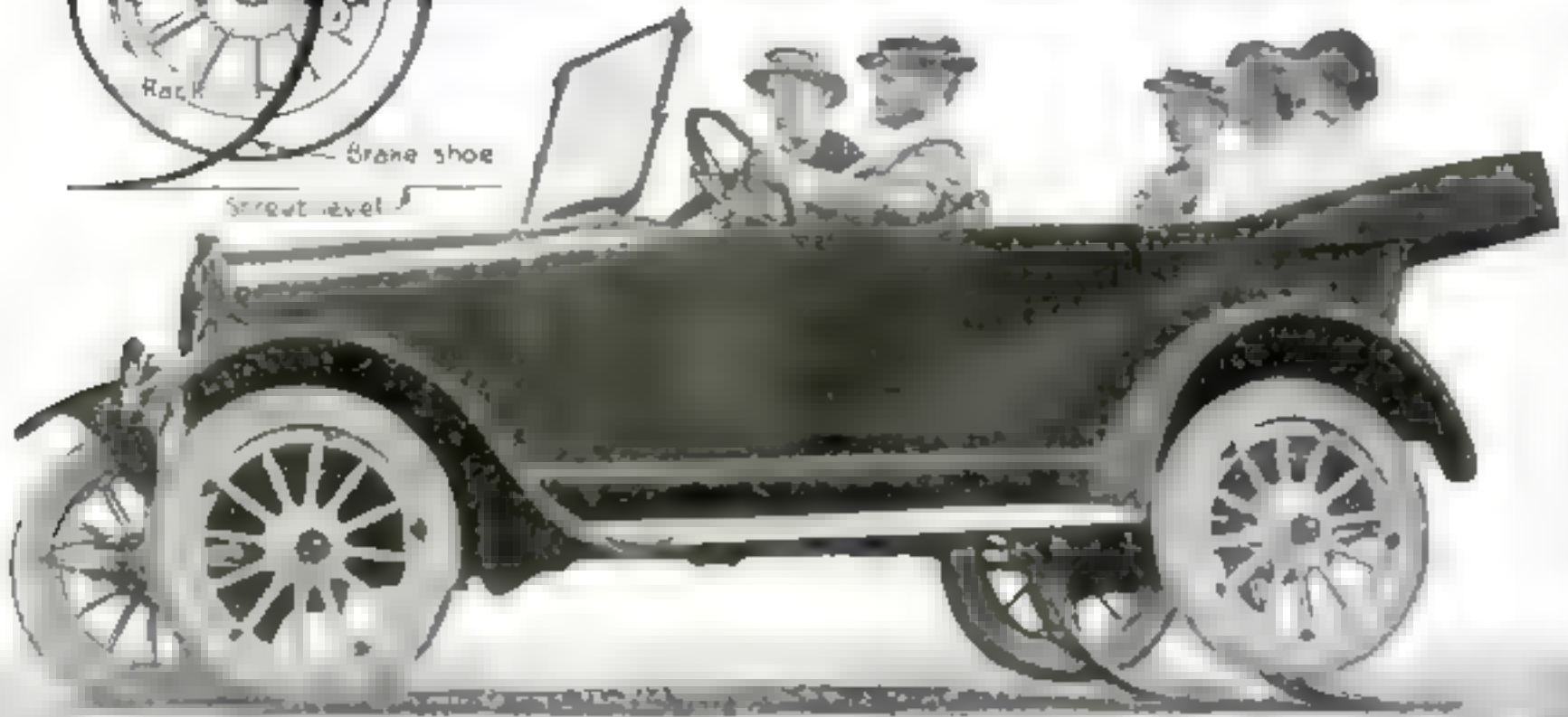
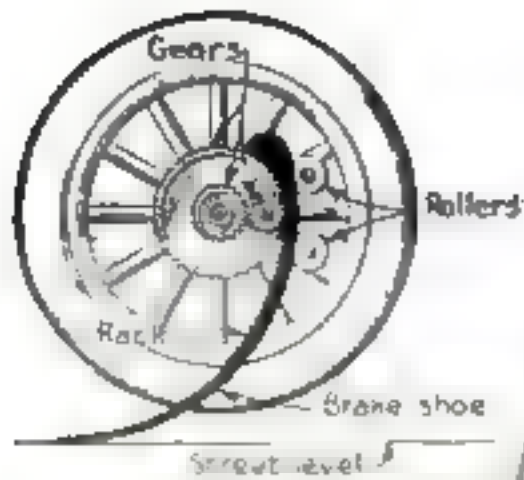
Crude as this type of conveyance seems, no rubber-tired automobile could travel with less jolting. The carriers work in relays, going slowly, with a kind of swing, and resting at intervals.



The Chinese ambulance. It is just like the conveyance in which pigs are taken to market

Lifting a Car to Stop It

A brake which raises the rear wheels clear off the ground. Of course the car has to stop



Two flat semi-circular steel shoes placed between the body of the car and the inside of the rear wheel on each side, are pushed down by a lever in such a manner as to lift the rear wheels

AN unusual type of automobile emergency brake stops the car by lifting the rear or power wheels clear off the ground. It consists of two flat semi-circular steel shoes thick at the top and tapering off at the bottom. These are placed between the body of the car and the inside of the rear wheel on each side.

A toothed rack is cut along each edge of the upper side of the shoe, the rack-teeth respectively meshing with the teeth of two ordinary spur-gears slipped loosely over the rear-axle housing and provided with cam-shaped clutches on their facing sides. A collar with reverse cam-shaped clutches is rigidly attached to the axle between each of the two spur gears. Two rollers carried on studs attached to the vehicle frame are employed to contact with the under or bottom side of each steel shoe and keep the racks on its upper face always in mesh with the two loose spur gears.

Either one of the spur gears may be rigidly attached to the turning rear axle by sliding it into contact with the clutch collar. The rotation of the collar revolves the gear in contact with it so that it causes the shoe to be moved down into contact with the ground and lift the rear wheel clear off the road. The friction between the shoe and the ground causes the vehicle to come to a gradual stop without the shock incident to the operation of the

conventional band brake. When the shoe has been lowered the specified distance, further downward motion is prevented by the teeth of the gear running off those on the rack, the thicker section at the top of the shoe serving as a wedge to hold it in that position.

The lowering of the car-wheels on the ground after a stop, is accomplished by unclutching the first gear from the axle collar and clutching the other one. The same direction of rotation of the axle is made to lift the shoe up off the ground by means of a small gear interposed between the gear in clutch and the rack teeth.

The clutching of either gear with the collar between is secured by means of a longitudinal lever with a double-acting bell crank and pedal on the floorboard of the driver's cab.

Two pedals and two levers are employed, one for each set of loose gears. One pedal is made to suffice for the similar-sized gears on each side of the car by means of a crosswise equalizer at the rear as shown. This assures simultaneous action by each shoe.

Obviously the automobile will come to a comparatively short stop upon the application of the brake and will not be likely to skid or slide even on a steep grade as long as the steel shoes remain on the ground in their braking position.

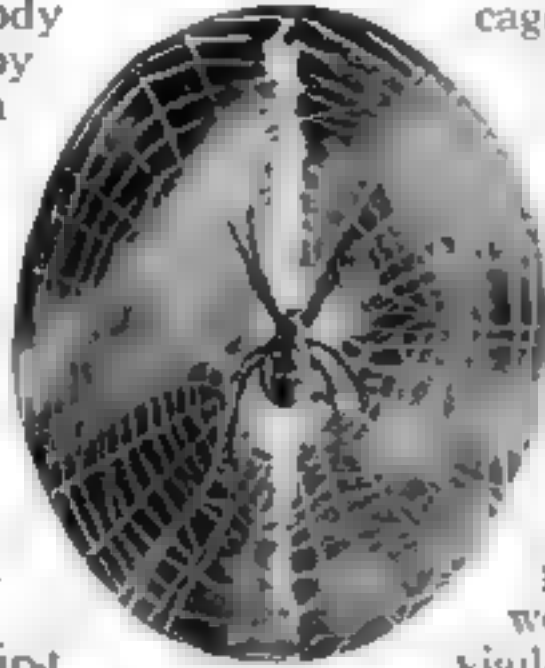
Like a Spider in His Web

So the guard sits in one of the new circular cell houses of Joliet Prison. He can keep watch over two hundred and forty-eight cells

By Fred Telford

OCCASIONALLY somebody earns the title of genius by transplanting into action what others regard as impossible or lack the perseverance to carry through. Seemingly this is what fate has in store for W. Carnys Zimmerman, of Chicago, the architect of the new state penitentiary in course of erection near Joliet, Illinois, which is not only built along new lines but is the last word in prison construction.

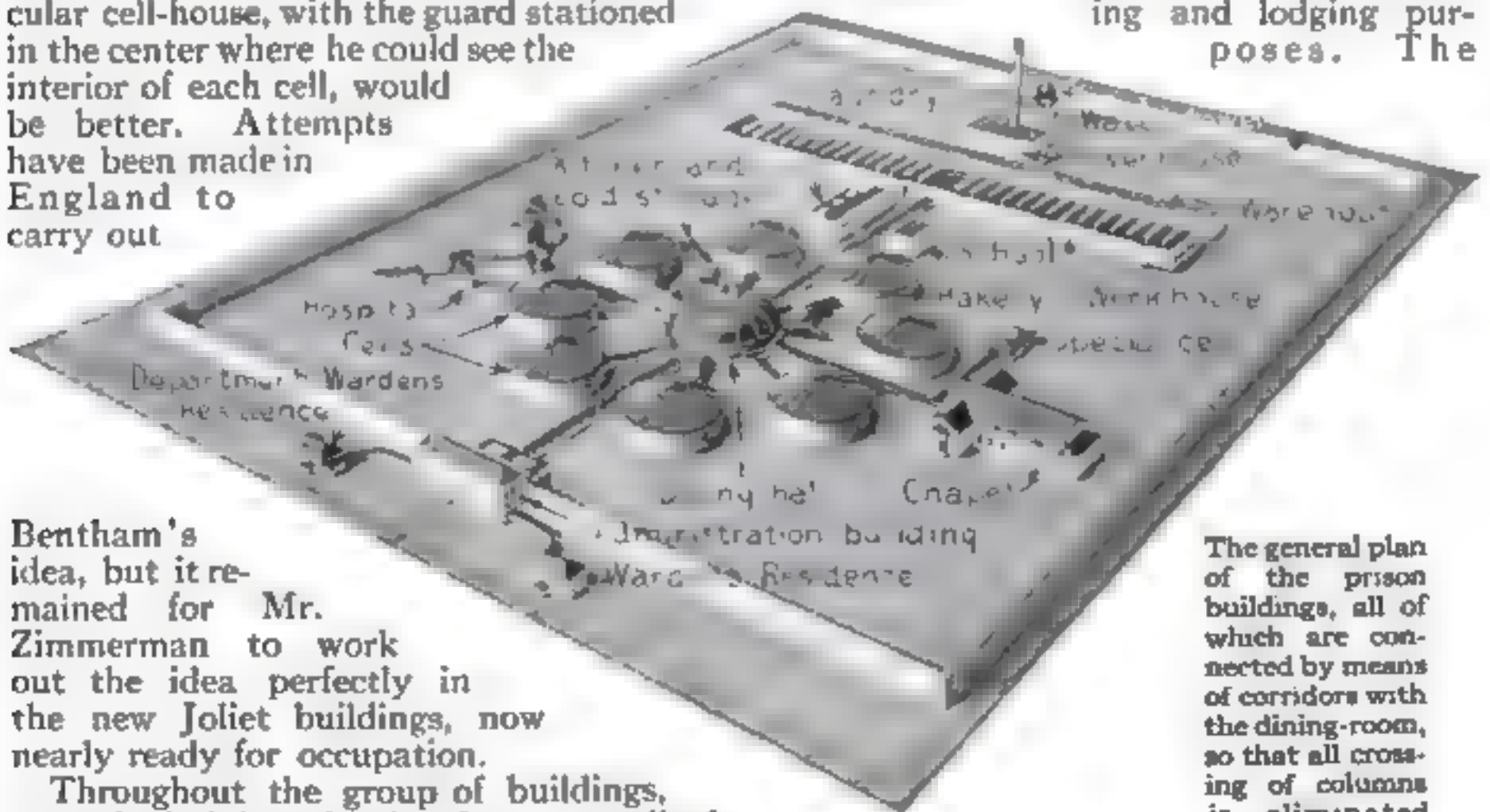
Jeremy Bentham was the first man who seems to have realized that the consequences of imprisonment should be calculated both in their effect on the convict and on society. More than a century ago he proposed that the conventional prison building with its long tiers of cells invisible to the guard except when he walked in front of them, was well calculated to defeat its own purpose, and that a circular cell-house, with the guard stationed in the center where he could see the interior of each cell, would be better. Attempts have been made in England to carry out



cage in the center of each cell house.

Thus he can see into any cell on any tier at any time without taking a step. As the guard's own room is in darkness, no prisoner can ever be sure that he is not under direct observation. With the old straight row of cells, the prisoner could be observed only while the guard was passing his cell; moreover, the guard's approaching footsteps were an audible warning to a vigilant prisoner.

The same idea is carried a step further in the grouping of the eight circular cell houses about a circular dining-room, with a covered corridor leading directly from each cell house to the part of the dining-room to be occupied by the prisoners from that building. Thus all crossing of columns is eliminated, and in effect each cell house is a unit for eating and lodging purposes. The



The general plan of the prison buildings, all of which are connected by means of corridors with the dining-room, so that all crossing of columns is eliminated

Bentham's idea, but it remained for Mr. Zimmerman to work out the idea perfectly in the new Joliet buildings, now nearly ready for occupation.

Throughout the group of buildings, ease of administration has been a cardinal principle. The most radical departure from the conventional style is the shape of the cell houses. The 248 cells are arranged in four tiers around the periphery of the structure, while a guard is stationed in a

accompanying drawing shows clearly the general plan of the prison colony. At the same time, economies are effected by preparing food in a central



The cells are arranged in four tiers around the periphery of the structure, while the guard is stationed in a cage in the center where he can look into any cell on any tier at any time

station, as the kitchen, bakery, and store rooms for food are situated in the spaces between corridors.

Two large workrooms are placed far in the rear, but are also connected with the dining-room by a corridor. Warehouses for the storage of raw material and manufactured products are just in the rear of the workrooms. At one side is the chapel, with a stage, a large auditorium, and separate rooms for those of Catholic and Jewish faith. Opposite the chapel is the hospital, with special wards for those suffering from tuberculosis and contagious diseases. The laundry and shower baths are in a separate building at the left. Outside

the enclosure are the residences of the warden and his deputy, while between corridors leading from the cell houses to the dining-room are houses for the guards and private dining-rooms.

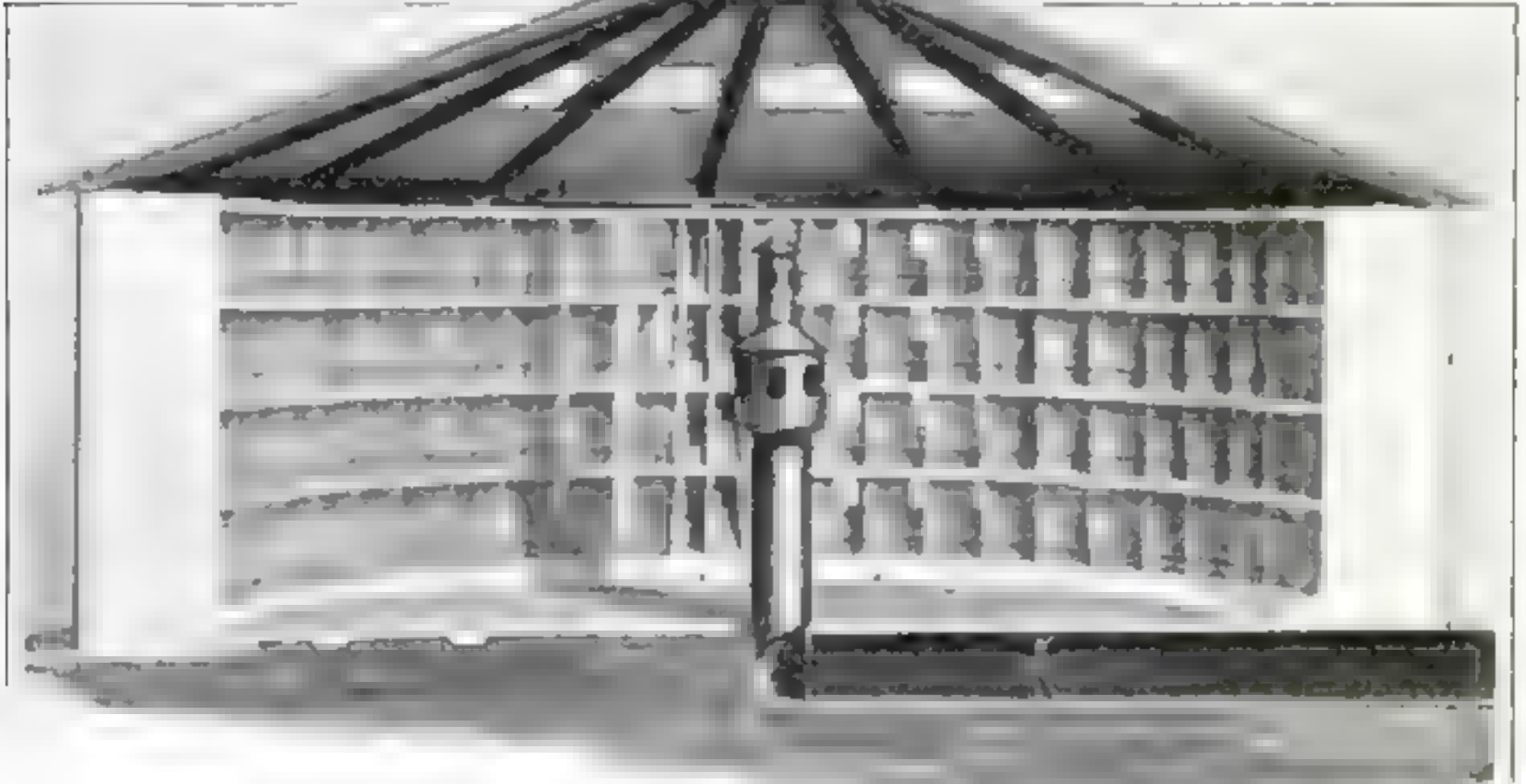
A cardinal principle recognized by the architect was that while the state has the right to confine those who violate the laws, and can in fact protect itself in no other way, yet the prisoner's right to comfort, sunlight, air, and the other necessities for health is inalienable. Consequently, much attention was given to sanitation in the buildings. Fortunately the circular construction makes possible many sanitary features not possible in

any other style of prison architecture.

The most striking sanitary feature is the lighting. Each cell, being on the periphery of the building, has an outside window; in addition, by means of a skylight and refracting glasses, direct sunlight reaches every cell every clear day. The small height in comparison with the diameter—each cell-house is 150 feet in diameter—makes little refraction necessary, even for direct sunlight to reach the cells on the north side on the lower floor. It is expected that on clear days each cell will have at least two hours of direct sunlight on short winter days.

ture of seventy degrees in the cells when the outside temperature is ten below zero. A radiator is placed in each cell. There is also a lavatory and water-closet for each cell, with running water.

Although ease of administration and sanitation have been given great attention, there has been no neglect of the primary purpose of the buildings—to confine prisoners. In fact, the close observation made possible by the circular arrangement, the elaborate construction to prevent egress at the windows, and the front and doors of glazed steel make escape all but hopeless.



The circular construction makes excellent lighting possible. Each cell has an outside window and gets the benefit of the skylight. The guard enters his cage through an underground passage so there are no resounding footsteps to warn the prisoners when he is approaching or leaving.

Fresh air is furnished through ducts in the triangular shaft between each pair of cells. Air is drawn from the outside over blast heating-coils and through a water spray washer; it then passes directly to each cell in the building. As each cell is really an individual room, the air leaves through the transom over the door and is forced out through the central space and into the open air through an opening in the skylight. In the usual prison the cells are supplied from the foul air in the corridors. Of course the windows, opening on the outside, may be used for supplementary ventilation.

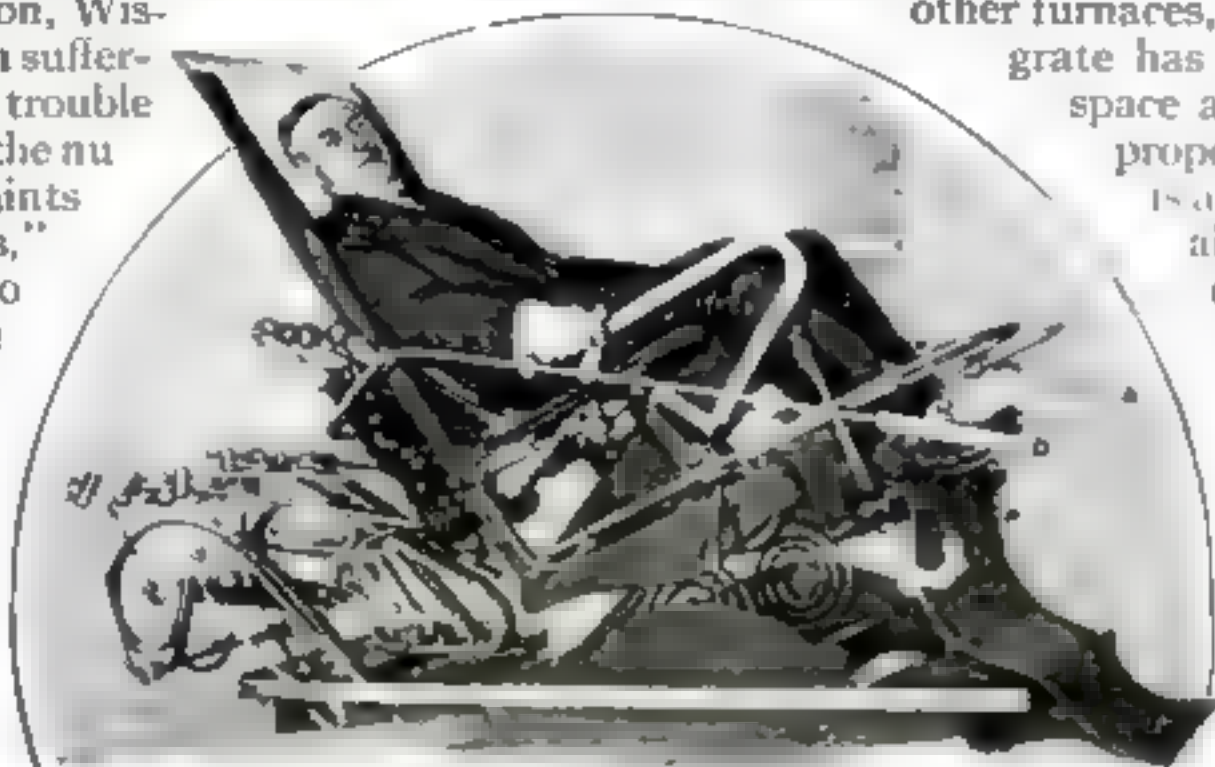
The heating system, which is entirely independent of the ventilating system, is sufficient to maintain a uniform tempera-

The plan of construction is, in its way, as remarkable as the plan of the buildings. All the work is done by honor prisoners working under the direction of a general superintendent and a foreman chosen by civil service examinations. Although the new buildings are outside the old prison-walls and the men are unguarded, not one attempted to escape at the time of a recent outbreak in the penitentiary proper. The work has been considerably delayed because the number of honor men has not been as large as was planned for.

Though the general plan marks a radical departure from the old style prison, there seems to be little doubt that it will be widely copied by other states when new construction work of this kind is undertaken.

The Massaging Chair. Sit in It and Let Two Rollers Knead Your Spine

BY means of a chair that has recently been invented by Halbert L. Hoard, of Fort Atkinson, Wisconsin, a person suffering from spinal trouble or from any of the numerous complaints due to "nerves," is enabled to perform the otherwise difficult task of massaging the back and especially the spinal column without the assistance of a professional. A number of hard rubber rollers are pressed against your back by strong springs attached to the roller carriage. By moving a pair of handles up and down, the rollers are similarly moved up and down, the springs keeping them pressing uniformly against your back. With every stroke, the circulation through the blood vessels is increased, and unquestionably, *some* good is attained.



The massaging rollers, pressed in by strong springs, are moved up and down against the spine by means of the handles

How One Furnace Can Save a Big Slice of the Country's Coal Bills

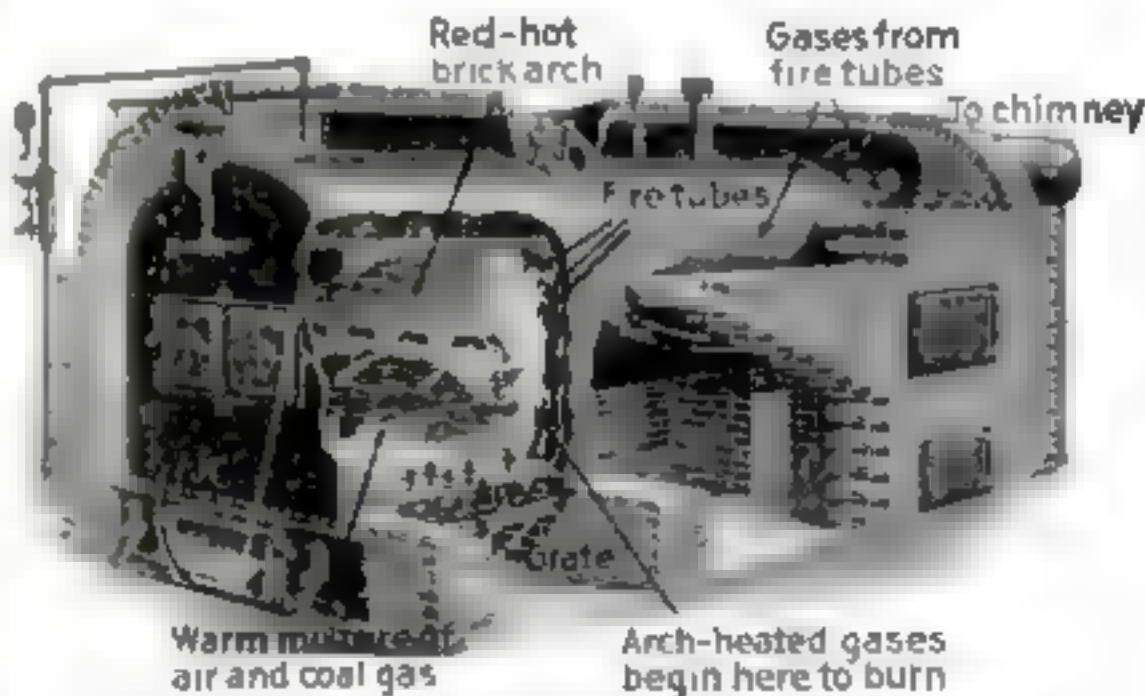
FULLY one fourth of the coal used in heating our country's homes is wasted, simply because the average furnace is not properly designed to burn the highly combustible gases that are contained in the coal. The greatest part of our country's coal supply is what is called bituminous, or soft coal, which contains on an average forty-five per cent of highly combustible gases which in themselves form a large portion of the heat value of the coal. Gases are distilled from the coal at low temperatures and must be thoroughly mixed with a sufficient supply of air and raised to the proper temperature before complete combustion takes place. In other words, prevent the gases from escaping before complete


combustion has taken place—that is the solution of the problem.

This idea has been carried out in a furnace, the boiler and foundation of which differ not at all from those of other furnaces, except that the grate has the proper air-space area so that the proper amount of air is admitted to burn all of the gases completely. As the air enters under the grate and penetrates upward through the incandescent coals or hot bed, it mixes thoroughly with the gases and all pass

through the hot bed of coal between the grate and the lower extremities of an arch. The arch is directly over the hottest part of the fuel bed, hence, the gases are liberated immediately back of the arch at the highest possible temperature and come in contact with the heating surface of the boiler after complete combustion has taken place. Thus all the available heat is expended directly upon the boilers, almost none of it escaping up the chimney or out into the room.

Since all the carbon burns, no soot will collect on the fire tubes. Thus still another saving results from the keeping of the tubes free from this heat-insulating substance.



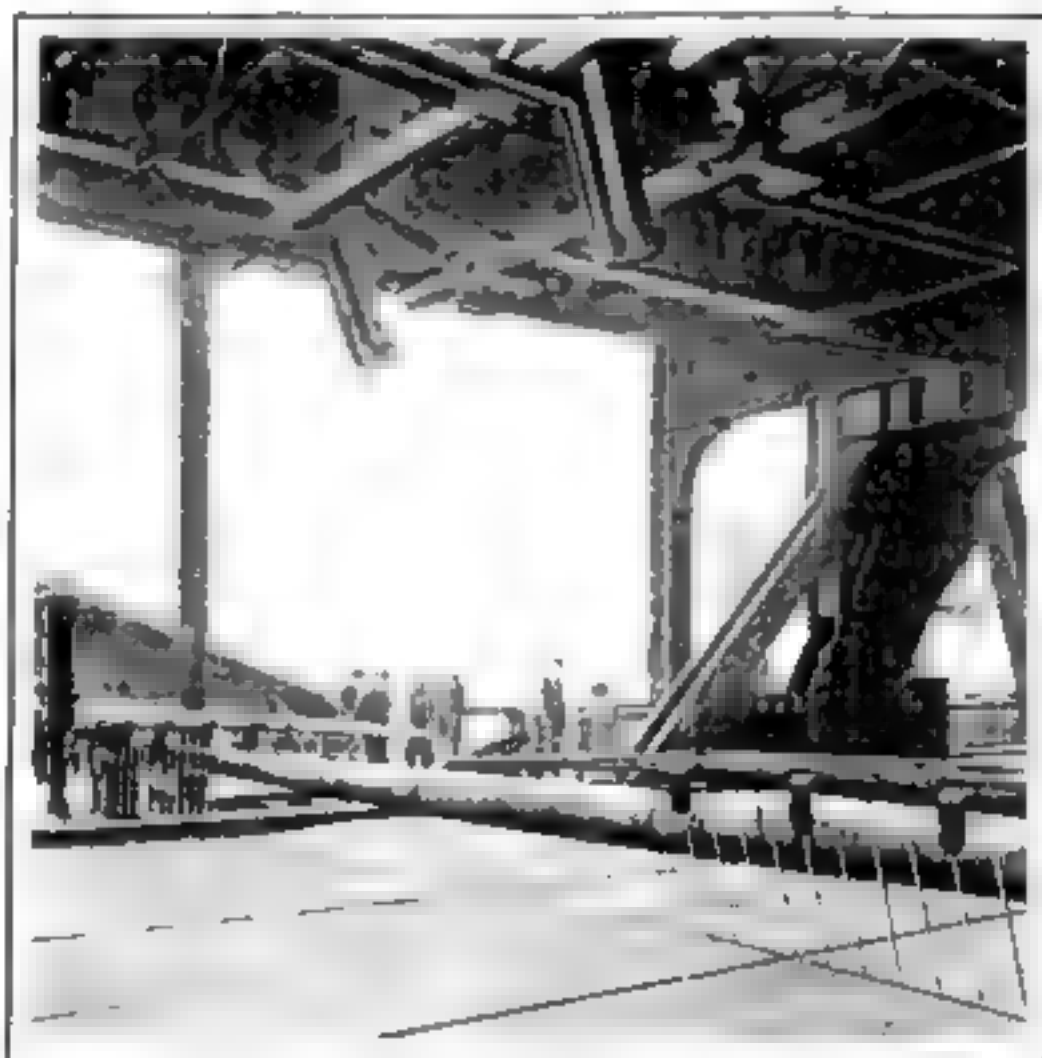
The grate has the proper air-space area into which sufficient air is admitted to burn all  thoroughly

Safeguarding Our Bridges

The cushion gate and the yielding barrier are two effective remedies

RECENT accidents in Boston, Chicago and Vancouver have at last aroused the public to the realization that changing conditions have made obsolete devices used at the present time to protect bridge approaches and railroad crossings. A cushion barrier gate devised by the Chicago bureau of engineering seems to have solved the problem of the improperly protected bridge approach and the yielding chain barrier for railroad crossings promises to do much to lessen the number of accidents.

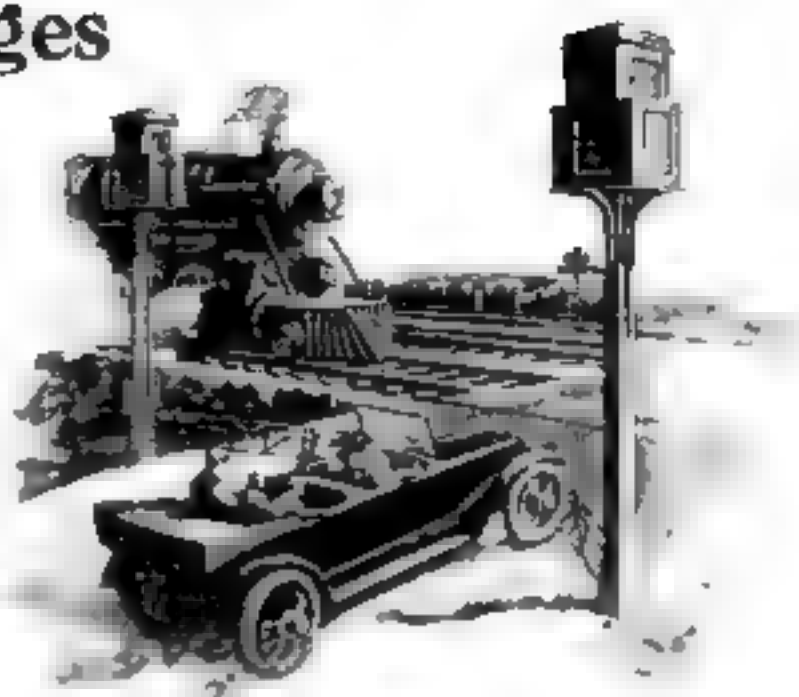
The cushion barrier gate, which has been installed at the Lake Street bridge, in Chicago, consists essentially of a forty-two-foot boom of Douglas fir, sixteen inches in diameter, suspended



The cushion barrier gate which recently stopped a street car running at ten miles an hour without damaging the car. See diagram at left



from the top of the bridge by two heavy twelve-inch pipes. The boom, which weighs a ton, serves as a buffer to stop a street car or automobile running at high speed without wrecking it or causing serious injury to the occupants. When a car bumps into the boom, the boom rolls for two feet, then slides for eight feet, and then for the next five feet slides and rises two feet, so that the car not only has to



Automobile running into the yielding chain barrier, which consists of a steel truss strung between uprights

overcome the inertia of a heavy weight but acts against gravity on a total weight of over five tons.

Danger of dropping the boom on a street car is eliminated by an ingenious device. Each time a street car enters the bridge, it automatically turns a cog wheel one notch. The boom, which is in position

against the top of the framework, cannot be dropped by the bridge tender until the car pushes forward another cog wheel when it passes off the bridge at the other end.

The lighting system, which is also unique, has proved highly effective. The engineers have utilized the well-known principle, little used for bridge signals, that a light which goes on and off at short intervals catches the eye quicker than any other. The red lights first come on at the "Stop" sign at the left. Then in quick succession the lights in the gate at the left, in the gate at the right, and the "Stop" sign at the right

come on. Each light remains on only a fraction of a second. The whole effect is that of a giant swinging a large red lantern. So effective is the lighting system that in the year since the barrier gate was installed not a single accident has occurred. On other bridges not thus equipped the gates are out of commission much of the time owing to the fact that automobiles run into the gate arms.

Recently a trial test was deliberately made with a street car running ten miles an hour. At that speed the car had a striking weight of fifty-three thousand-foot pounds. The street car was brought to a complete stop in fifteen feet. The car was not damaged in the least, and the motorman, who remained at his post, was not even severely shaken up. The barrier gate was also undamaged.

The yielding chain barrier for railroad crossings and for bridge approaches frequented by light traffic, consists of two uprights or structural steel posts, one at each side of the roadway, connected at the top with a steel truss. The weight of the barrier is counterbalanced by means of a counterweight contained within the two side posts. When struck by a vehicle the barrier gives, the chains paying out, and gradually absorbing the energy of the shock until it brings the vehicle to a stop.

We Burn Coal Lavishly, But We Have Plenty of It to Burn

WHILE it is true that the United States is the largest consumer of coal in the world, using nearly forty per cent of the world's total production, it is something of a comfort to know that we have not yet consumed

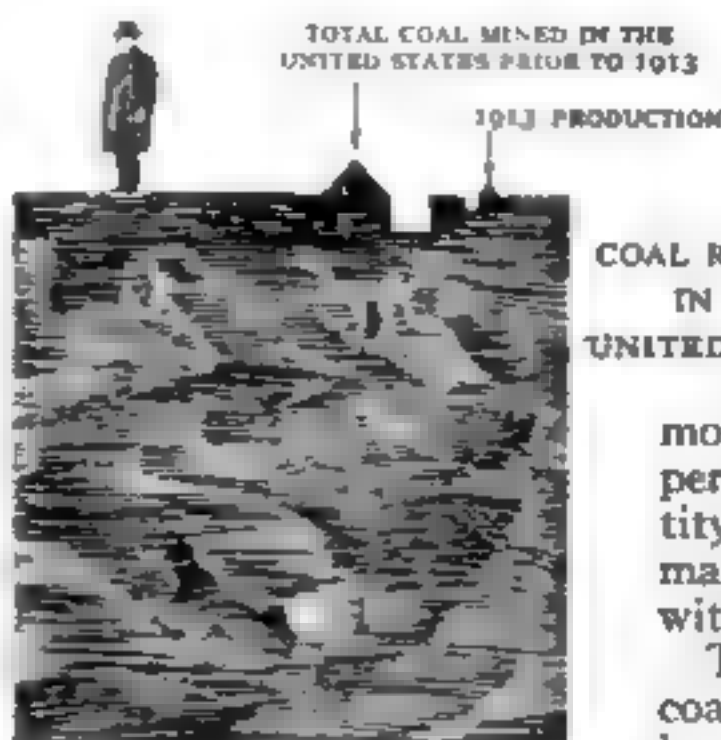
more than one-half of one per cent of the total quantity which geologists estimate is at present contained within our borders.

The annual production of coal in the United States has increased more than eight hundred per cent in thirty-five years—from sixty-eight million tons in 1879 to more than a half billion tons in 1913. Notwithstanding the enormous amount of coal available, our exports in 1913 amounted to very little, only about four per cent of the entire output. In this year Great Britain ranked second as a coal producer.

Coal was first worked in the United States in Richmond, Virginia, in the middle of the eighteenth century, and indeed that State in proportion to its size, long surpassed all the others in varieties of coal produced, and area of coal measures, though there it had the disadvantage that the coal was generally deeply buried. In 1820 the total output of coal in the country was three thousand four hundred and fifty tons; by 1850 the annual output was over seven million tons.

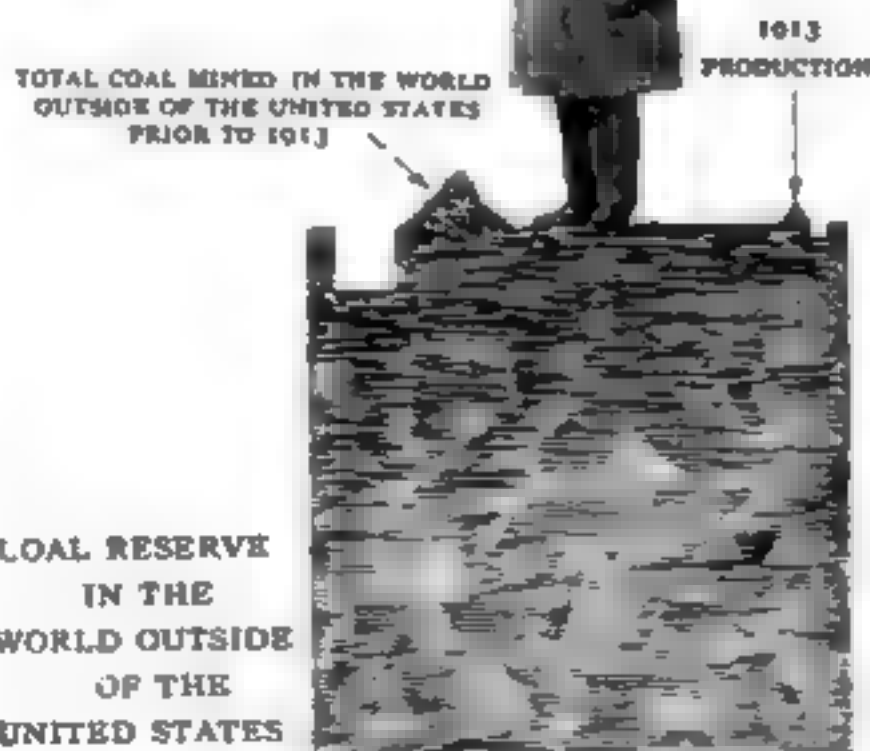
According to the United States Geological Survey the total area of coal-beds is close to five hundred thousand square miles, of which about one-half contain anthracite and bituminous coal.

POPULATION OF THE UNITED STATES



The coal mined in this country up to 1913 and what we still have on hand

POPULATION OF THE WORLD OUTSIDE OF THE UNITED STATES



COAL RESERVE IN THE WORLD OUTSIDE OF THE UNITED STATES

Comparison between the world's population and coal reserve. We have used less than one-half of one per cent. of the total quantity

Shifting Gears by Electricity

It requires but one operation to shift from neutral to high gear

IN a patent recently granted to John C. Brackett, of Copper Cliff, Ontario, a mechanism is described which electrically controls the entire range of the speed of a gasoline automobile without recourse to shifting the change gears by hand. This control is centralized in one lever on the steering-wheel, which lever can be so manipulated that the car can be started from neutral to reverse speed or from neutral to a high forward speed on the high gear.

In principle these results are obtained by means of a master switch, placed in an electrical circuit between a solenoid to throw the driving clutch of the automobile in or out of

mesh, and six other solenoids, two for bringing the gears to neutral position and one each for the reverse, low, second and high speeds. These solenoids are arranged to shift the ordinary change-speed gears of the automobile by conventional shifter bars.

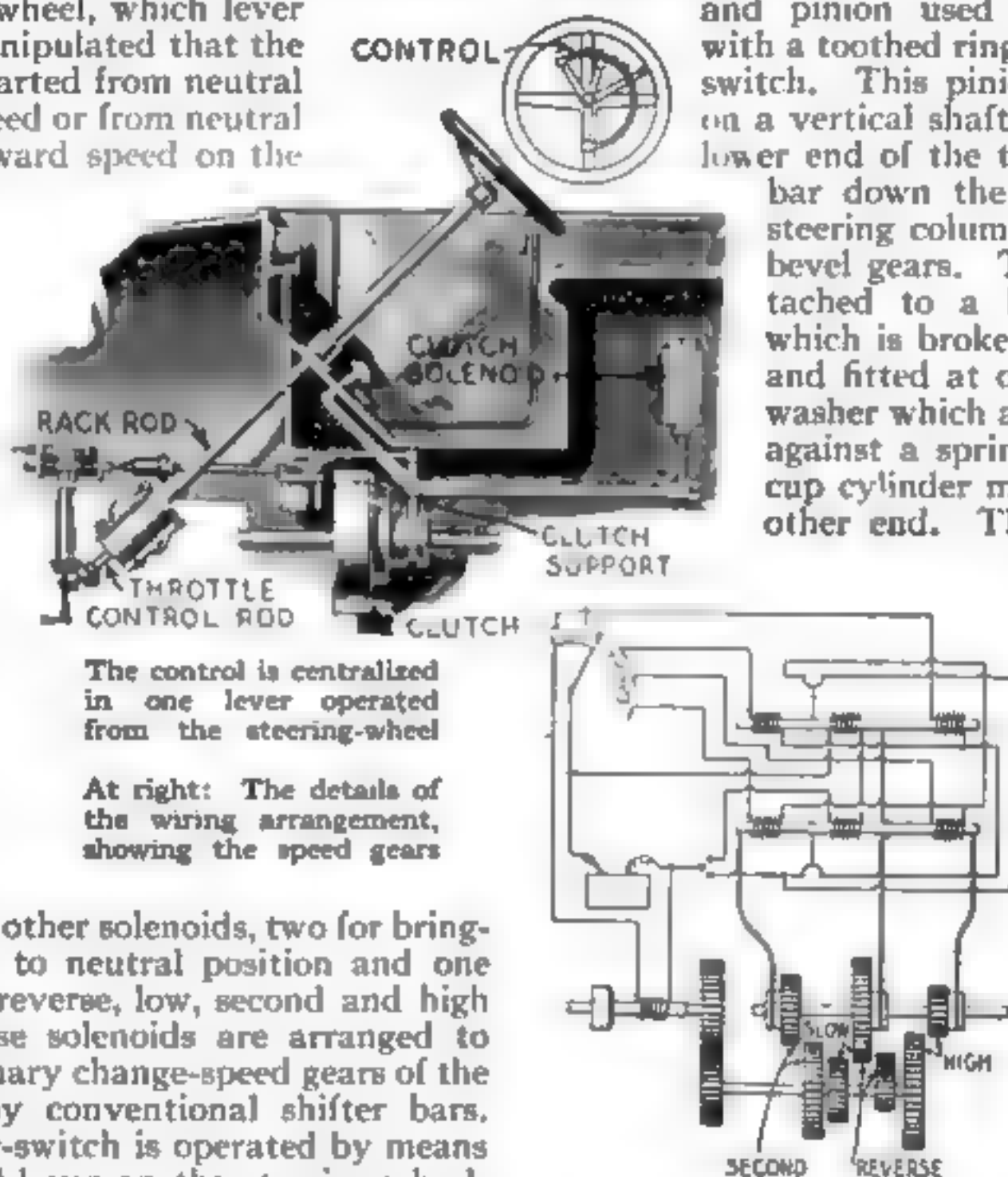
The master-switch is operated by means of the control-lever on the steering-wheel. The position of the lever is regulated by means of notches on a sector on the steering-wheel. These notches, corresponding with those of the master-switch, are wired to the various solenoids so that a movement of the lever automatically disengages the clutch by energizing its solenoid and at the same time closes one of the gear-shifting solenoids. This causes the gear with which that solenoid is connected by means of its shifter arm to move into mesh.

The control lever may also be moved from neutral to high speed in one operation to start the engine automatically, pick up the car on first speed and then through intermediate gear to high gear. This is accomplished by means of a self-starting relay switch on the dash of the car and a rack and pinion used in connection with a toothed ring on the master switch. This pinion is mounted on a vertical shaft driven off the lower end of the throttle control

bar down the center of the steering column by means of bevel gears. The rack is attached to a horizontal rod which is broken at one point and fitted at one end with a washer which acts as a piston against a spring carried in a cup cylinder mounted on the other end. The rod is then

extended and formed into a second rack which meshes with the toothed ring on the master switch, the latter being in the form of a vertical cylinder with the solenoid

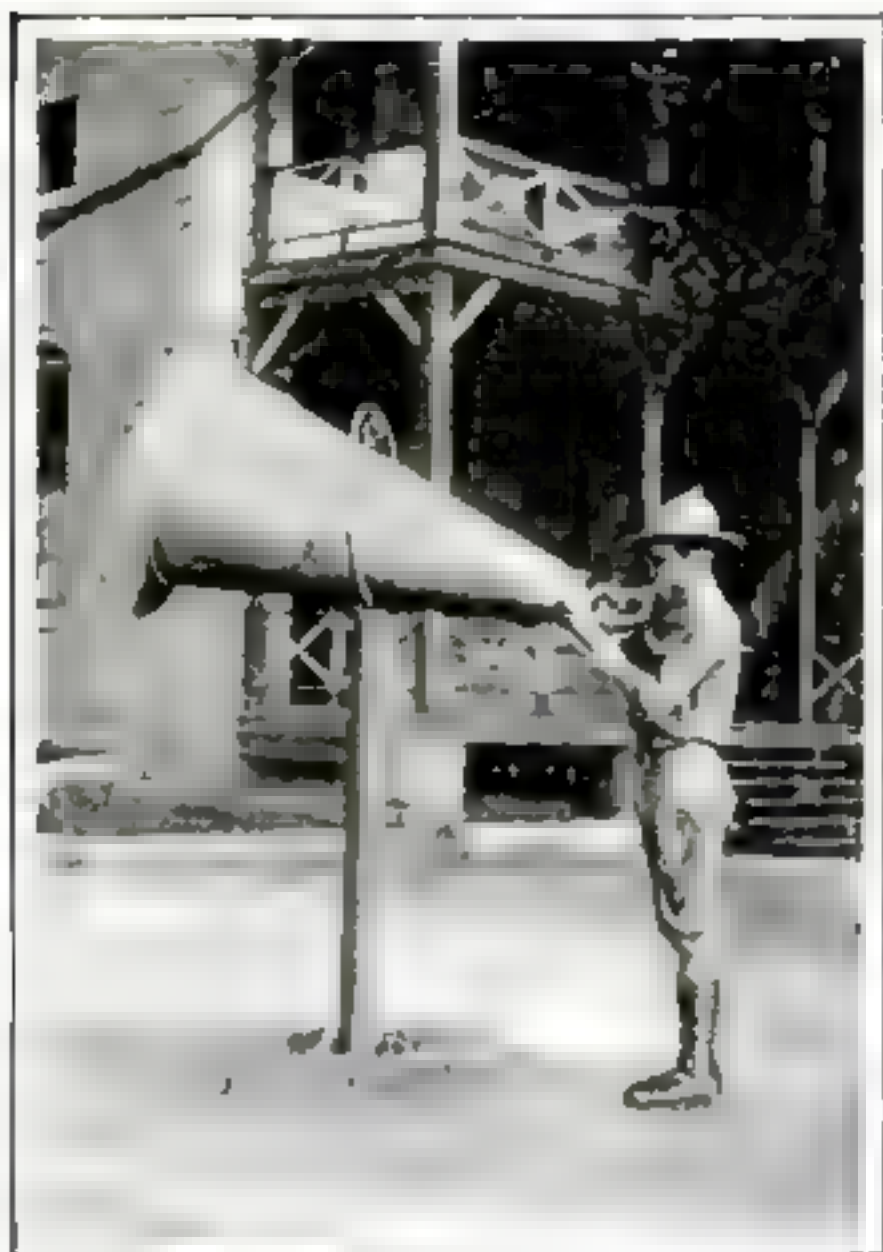
contact points on the curved surface. The toothed ring also has a set of interior and exterior notches corresponding to those of the control and solenoid contact points. The rack rod with its spring cylinder works in opposition to a rod connected with the clutch shifter arm. This rod is also fitted with washers and opposite-acting contracting springs, the former carrying rollers which contact with the notches on the master switch ring.



The control is centralized in one lever operated from the steering-wheel

At right: The details of the wiring arrangement, showing the speed gears

All the specialized knowledge and information of the editorial staff of the Popular Science Monthly is at your disposal. Write to the editor if you think he can help you.



By James H. Hare in *Leisure's Weekly*

Augmenting the tones of the bugle by means of a giant megaphone at Camp Fort Riley

Megaphoning the Reveille—The Latest in Military Efficiency

IN the training camp at Fort Riley a huge megaphone has been erected on a stand to enable a field bugler to sound reveille with such a vim that it will be irresistible, as well as to put punch into the retreat which is sounded at evening parade after the band ceases its music. When the last note of the retreat has died away the band plays "The Star Spangled Banner" as the flag is lowered and the strenuous day at camp is officially over for the soldiers.

By the use of the megaphone to augment the bugler's tones, the one instrument is sufficient for the entire camp and its notes carry equally as far as those of the entire regimental band.



The woolen bottom of the cleanser is kept moistened with the cleansing fluid in the top

The More You Pay for Your Clothes, the More They Suffer in the Wash

THE price that we pay for cleanliness is, to a large extent, paid to the laundryman. According to an investigation made by the Mellon Institute of Industrial Research, at Pittsburgh, Pa., only forty-three per cent of the life of a collar, for instance, is consumed in the actual wearing of it. The other fifty-seven per cent is passed in the laundry and hanging on the line.

Should a perfectly new collar be laundered from thirty-five to forty times without being used at all, it would be worn to a frazzle when nearing its fortieth trip to the laundry. With ordinary wear between launderings, the limit of trips to the laundry is twenty.

The finer the texture of the garment or fabric to be laundered the more it suffers in the process, however scientific the methods of laundering may be. Just ordinary exposure to the air when hanging on the line, not considering the flapping in the wind, which is, of course, destructive to fine fabrics, affects the strength of the fabric more than would be imagined.

Here Is the Fountain Spot-Remover. It Works Like a Scrubbing Brush

BY means of a small cloth-covered brush containing a fountain filled with cleansing liquid, spots may be taken out of clothes at home. The woolen bottom of the cleanser serves to wash out dirt and grease without at the same time scraping off the nap of the garment, thus overcoming a common trouble in spot removers.

The cloth covering of the brush can be easily removed and another substituted of the same color as the garment to be cleaned, to prevent all danger of discoloration. The device works well with all kinds of cloth; it is especially effective with plush and velvet and even for portières and carpets.

She Was Torpedoed but Her Cargo Plugged the Hole

ONE of the most unusual salvages yet recorded in these days of submarine warfare is that of the Norwegian steamship, *Kongsli*, whose cargo of grain swelled to such an extent on the inrush of water through the ragged hole torn in her side by a torpedo, that the hole was clogged up and the water prevented from flowing in and sinking her. The vessel was torpedoed about fifteen miles off the coast of Holland and was later towed into Yumiden, near Amsterdam, where it was put into dry-dock and her hull repaired so that she was soon able to put to sea again.

A party of fishermen, approaching the vessel, found her abandoned, for the crew had left her as soon as possible after the torpedo had struck, because she had listed to a dangerous degree. Even the captain had given her up as lost.

The fishermen, clambering aboard to discover the trouble, were amazed to find that the ragged hole on one side and hull plates torn loose on the other by the force of the explosion had been very effectively plugged by the swollen grain as shown in the accompanying cross-sectional view.

Of course the ship was then merely floating on the ocean as a boy's boat made of a stick on a pond, and the fishermen were afraid to attempt to tow her because the rush of the water along her sides might have washed away the effective grain seal. Accordingly, they improvised bales made out of canvas filled with grain and forced these into the holes. This made the stoppage secure enough to enable the vessel to be towed to a nearby port.

Making a Fortune Out of Dust from a Cement Factory

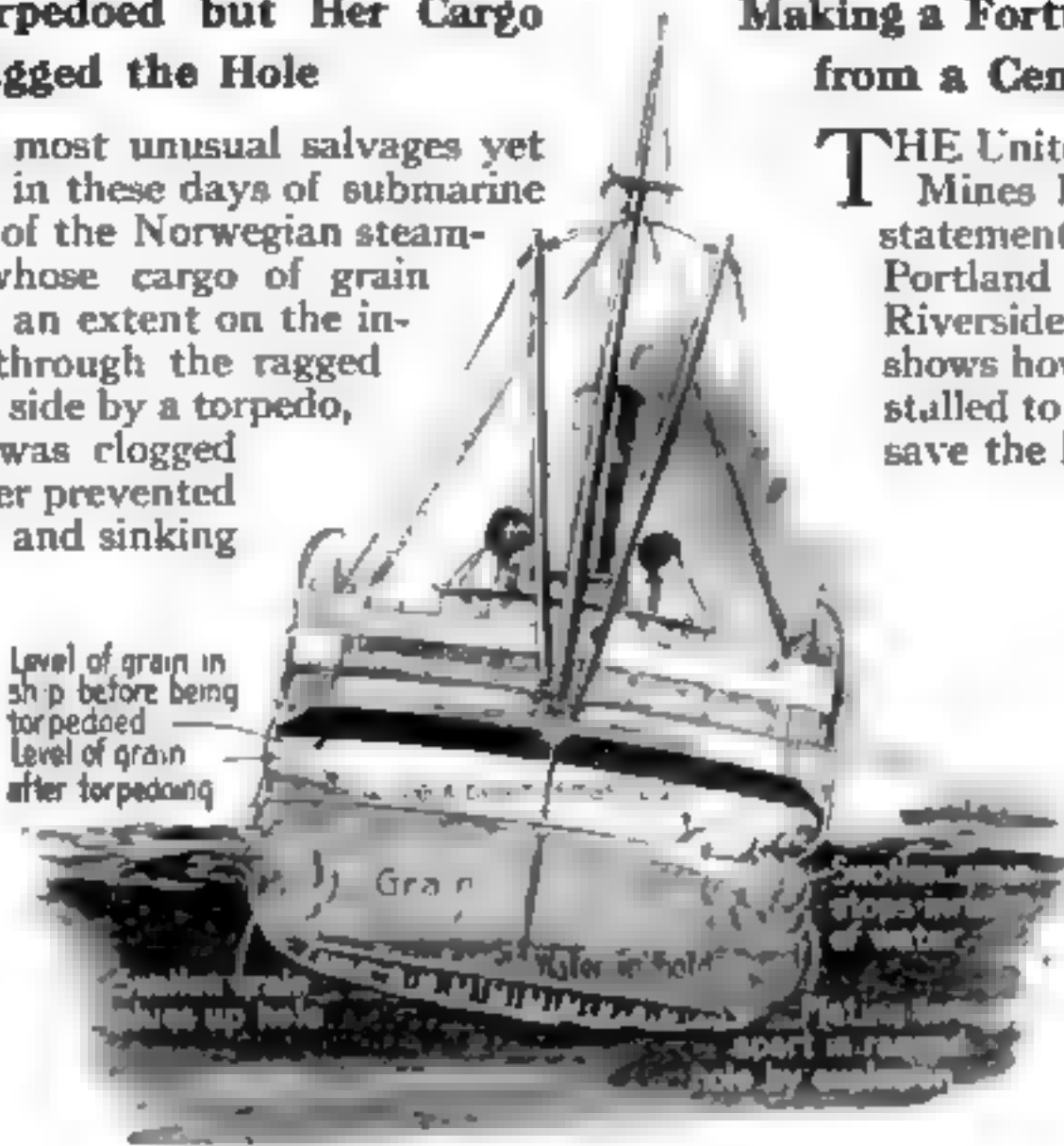
THE United States Bureau of Mines has lately issued a statement in regard to a Portland cement plant at Riverside, California, which shows how an apparatus, installed to avoid nuisance and save the health of the workers, has become the central feature of the whole establishment.

One of the great troubles of a Portland cement mill is the dust. It is likely to disturb vegetation by settling down on growing things, and it is very unwholesome. The

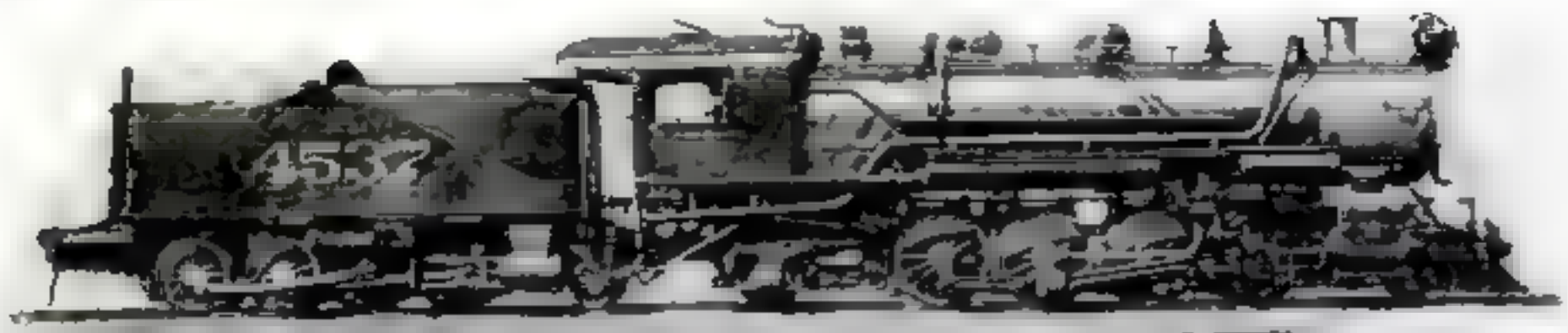
factory in question was in trouble on this account and it availed itself of Prof. Cottrell's invention to precipitate the particles on their way to the stack by means of electric currents. Now this dust contains potash, and so efficient is the installation that ninety per cent. of the content of this precious product is recovered in the form of potash salts. The present demand for potash in this country is something like Coal Oil Johnny's thirst, which, according to the legend, was unquenchable. As is well known, we formerly obtained our entire supply from Germany. These salts which they produce in California bring as high as \$400 and \$450 a ton.

The Riverside concern finds that its potash salt output pays its entire operating costs plus a reasonable profit, leaving the cement, which it will soon be producing at a rate of 5,000 bbls. per day, as clear profit. It has no immediate market for so much cement, but what is not sold is kept in storage.—ELLWOOD HENDRICK.

Level of grain in ship before being torpedoed
Level of grain after torpedoing



The inrushing of the water caused the grain to swell, so that it effectually plugged up the hole made by the torpedo



Note the engine cylinders under the tender. They increase the drawbar pull of the engine from forty-six thousand pounds, which is the power of the ordinary engine, to sixty-four thousand

Putting Driving Wheels Under the Locomotive Tender

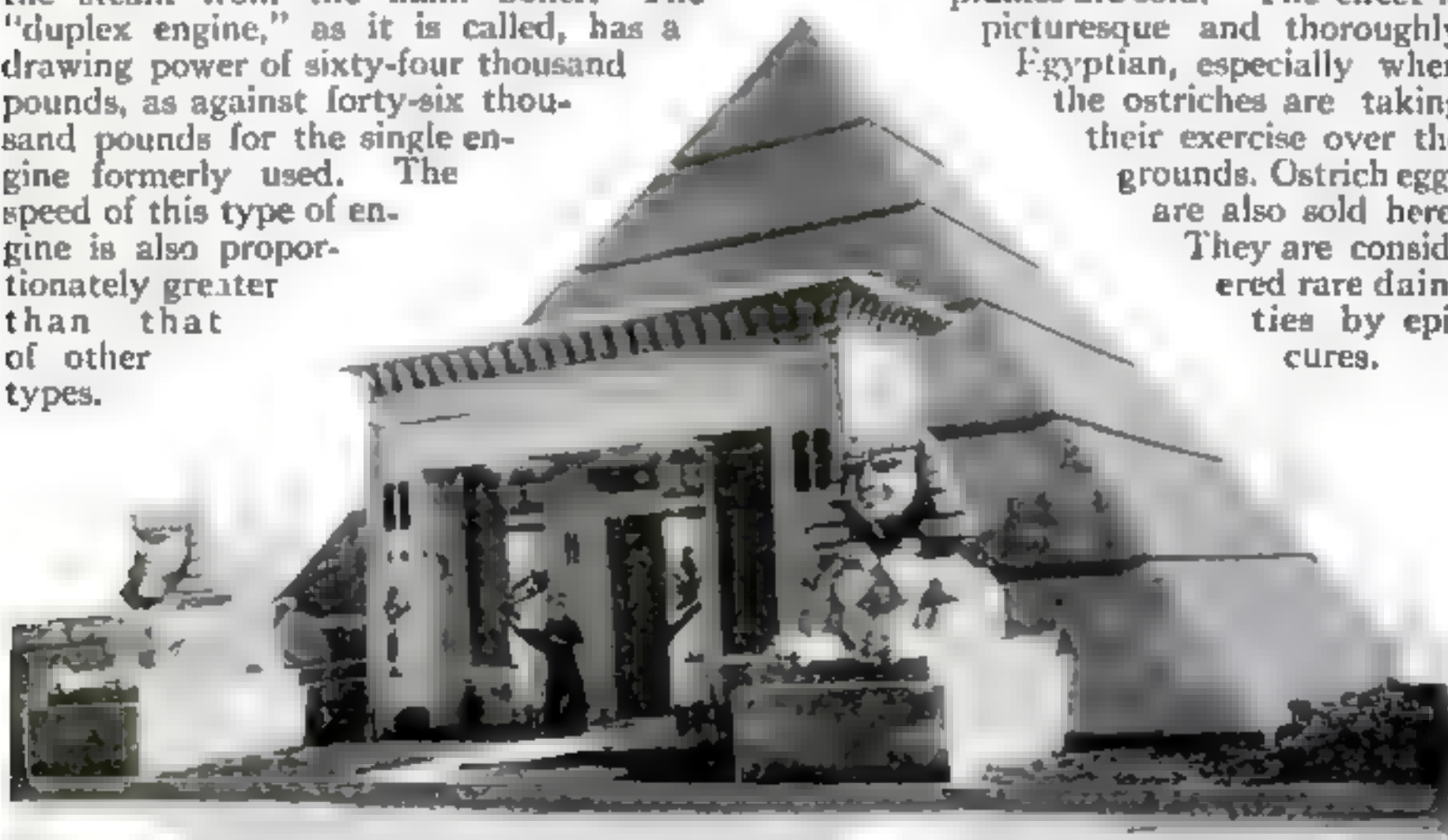
TO climb a steep stretch of track sixty-nine miles long on the Southern Railroad between Asheville, N. C., and Hayne, S. C., seven giant locomotives, with driving wheels under the tender as well as under the cab and boiler, are used. This novel arrangement makes it possible for a single engine to have no less than sixteen driving wheels, giving it a tractive power much greater than that of the ordinary locomotive.

By mounting tender-tanks upon the machinery of discarded locomotives, and by utilizing the frames, cylinders, wheels, axles, side-rods and valves of scrapped engines, the expense involved was reduced to its lowest terms. The tender has its own pair of cylinders, and flexible piping carries the steam from the main boiler. The "duplex engine," as it is called, has a drawing power of sixty-four thousand pounds, as against forty-six thousand pounds for the single engine formerly used. The speed of this type of engine is also proportionately greater than that of other types.

A Little Bit of Egypt on a California Ostrich Farm

WHAT! Has the hand of the West desecrated and commercialized the historic pyramids of Egypt? Does the over-decorated entrance shown in the illustration below, with its advertising signs printed in English and just visible behind one of the columns, mean that the ancient Pharaoh has been ousted from his last resting place? Not necessarily. A second glance at the photograph will doubtless reveal the fact that the object is only a small building with pyramidal outline and decorations suggestive of Egypt.

It is used as an exhibition room on an ostrich farm in California. Here the ostrich breeding industry is explained in detail to the interested visitor, and ostrich plumes are sold. The effect is picturesque and thoroughly Egyptian, especially when the ostriches are taking their exercise over the grounds. Ostrich eggs are also sold here. They are considered rare dainties by epicures.



An exhibition room in California, where the products of an ostrich farm are displayed. It borrows its construction from the Pyramids and symbolic structures of ancient Egypt

And These Are Not Leather?

They feel like seal, morocco, and cowhide; but suitcases, pocketbooks, bags and automobile seats, are made of cotton nowadays

DO you suppose that the luxuriant upholstery of a modern automobile and the seats and backs of most library chairs are made of leather? If you do, you must change your notions entirely. Things are not always what they seem. Your silk socks were once part of a tree that grew in a forest; leather is nowadays as often a form of downy cotton as the tanned hide of a steer.

It may startle you to know that these new forms of leather are varieties of gun-cotton. Fear not; they are not dangerous. The "gun" has been taken out of the cotton. A chemical compound which can blast a subway or blow up a Czar is converted into a necessary and peaceful substitute for cowhide for articles of clothing.

Originally, leather substitutes were manufactured solely for the purpose of producing a cheap upholstery material which would look like what it is not. In course of time, various improvements in processes and materials were made so that a real substitute for

leather was produced which actually wore better than some kinds of hide. Indeed, these substitutes were in part composed of leather, for they were, in reality, thin sections or sheets cut from the under side of the hide and coated and embossed so that they looked like real top side upholstery leather.

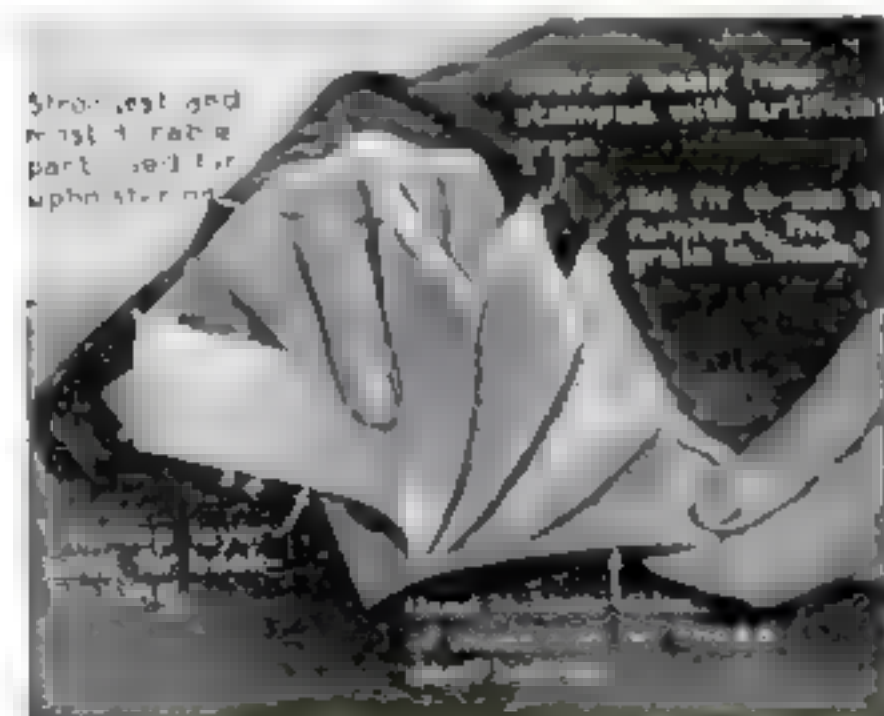
These "split" leathers and leather substi-



That fine-looking "seal" pocketbook which you admire in a shop window is nothing but dyed and embossed sheepskin and is quite inexpensive

good quality is indispensable; and just now there is not enough of it to meet these essential requirements.

Since the leather "split," which is coated and embossed or grained to resemble real hide, is really nothing but a foundation, manufacturers must have asked themselves: "Why not use a fabric base instead?" The experiment was made and a base secured.



At left: Thin sections or sheets cut from the under side of the hide and coated and embossed to look like real top-side upholstery

At right: Only the heel of this shoe is leather. The top, facings, tip, tongue and heel counter are of this material. Yet it will wear well



Those jaunty little outing caps—who cares if they are not real "leather?"

tutes have become of increasing importance because of the war. Not only are they cheaper, but they conserve leather. For harness, belting, saddles, boots, etc., leather of

from cotton. The coating is composed principally of soluble cotton. In the process the cotton is separated from foreign particles and washed. It is then nitrated, as it is called, which means that it is treated with a mixture of nitric and sulphuric acid and dried. In this form it is gun-cotton,—the most powerful explosive known.

Gun-cotton can be dissolved in certain ethers and alcohols, as well as a few other solvents. Thus dissolved, it ceases to be a violent explosive and becomes a sticky liquid, the body of which depends on the proportion of the cotton to the solvent.

This solution of cotton is technically called "pyroxylin." It is an indispensable material in many industries. Without it gas mantle dips, bronzing liquids, liquid court plaster, patent leather finishes, wood and metal lacquers and enamels could not be made cheaply.

In preparing leather substitutes pyroxylin of proper body is mixed with vegetable oils to impart elasticity; mineral pigments are added to give the desired color. The pyroxylin is applied to dyed cloth as it moves through a coating machine. A thin film is thus spread on the cloth from which the solvent evaporates. As the cloth passes through the machine, which is about one hundred feet long, it dries quickly. Again and again it is passed through the machine until the film is built up to form a coating of the required thickness, toughness and elasticity. The coated cloth is then passed between hot embossing cylinders of steel which press the coating so that it assumes the appearance of morocco, seal, walrus and other leathers. The resultant product looks, feels and wears

like leather, and to all intents and purposes, it is leather.

Very little morocco, seal and walrus leather actually comes from the animals

whose hides are so characteristically marked. Most of it is split cowhide embossed in the manner described.

That fine looking "seal" pocketbook which you admire in a shop window is nothing but dyed and embossed sheepskin. Only an expert could tell that the product is not what it purports to be. The principal difference is not in the appearance but in the price.



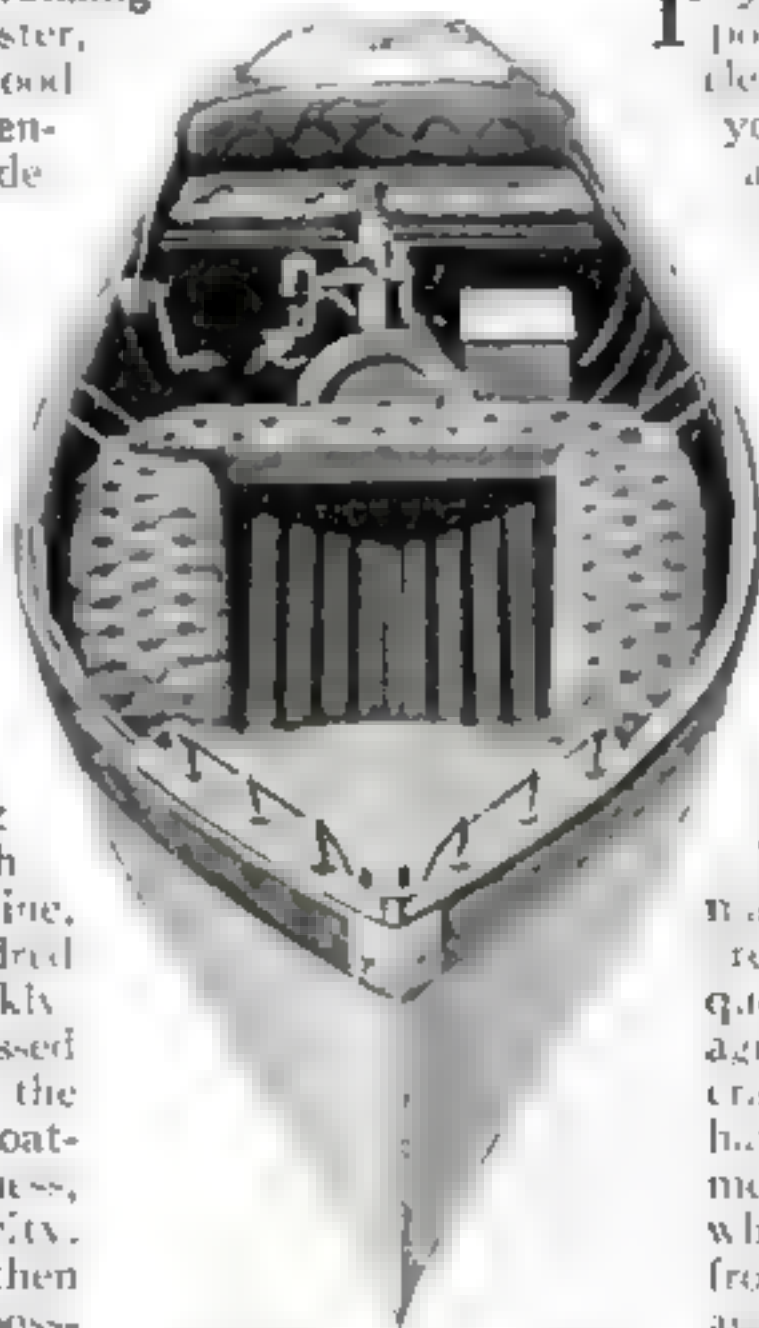
The material from which this hand-bag is made looks, feels and wears like leather and to all intents and purposes it is leather

If You Had No More Teeth Than an Elephant You Couldn't Be a Soldier

IF you have ever had the opportunity to look inside an elephant's mouth you have your own personal opinion about the reason why it grows a trunk so long that it covers the mouth completely and conceals the interior even when the mouth is open. For the elephant is shy of teeth. There are none at all in the front and only eight—two molars above and two below on each side—in the whole cavernous mouth.

Each of these molars is as large as a man's hand. The hay and fodder which make up the elephant's food are shifted over them by the queerest, ugliest tongue imaginable. The tongue is literally hung at both ends, having no power of movement except in the middle where it shifts back and forth from side to side, arching up against the roof of the mouth like a huge wrinkled pink serpent.

The elephant's baby teeth usually fall out when the animal is about fourteen years old.



Only an expert could tell that the "leather" of the upholstery is a substitute

Buying a "Used Car"

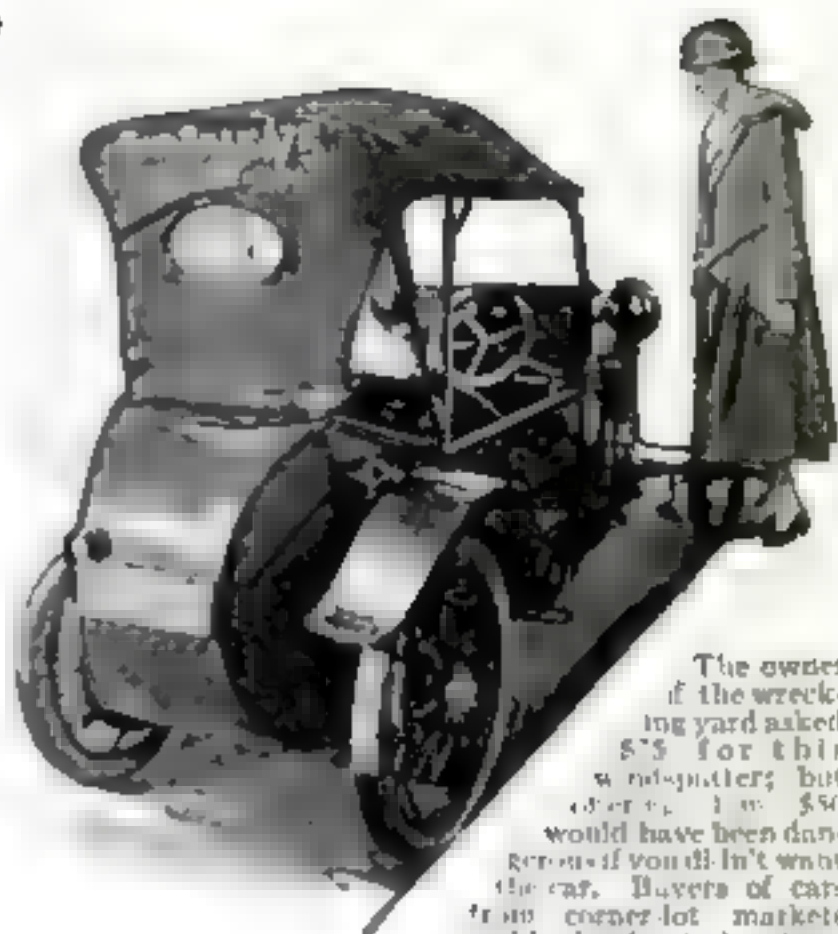
Among all liars we take off our steel helmets to the sellers of old cars

By Edward C. Crossman

WITH the enormous depreciation in value of the used motor car, and the ignorance of the average person of even primary automobile mechanics—and the ways that are dark of some gentlemen in the used car game—the average seeker of a satisfactory used car is apt to be fooled. The automobile is not so completely standardized as we are told it is. Development is still rapid. Devices widely heralded one year as marvelous improvements prove to be failures the next. And as added complication, most motor companies, at some time in their career, make an engineering mistake and turn out a model for which they are sorry. Yet, to the unwary, this model sells on the strength of the fine reputation of later and earlier productions. Second-hand, it brings a price far out of proportion to its value, purely because of the reflected glory shed upon it.

As the result of a slight improvement in appearance, a flock of second-hand Ford cars are on the market. In theory, so slight has been the change that it is impossible to be cheated badly in buying a Ford. Still, even the Ford Company made changes quietly as it went along, many necessitated as a remedy for grievous errors in design. Hence the buyer of an old Ford may find himself the buyer of a repair bill, reasonable as Ford repairs are.

The coming of the jitney business complicated the problem of the Ford used-car. For instance, one of my acquaintances loaded himself up with a good-looking Ford without going into its pedigree. It turned out to be a jitney veteran, with springs softened, frame sprung, and the general wear of a 'bus from that service, which means that it had been



The owner of the wrecking yard asked \$75 for this wind-upster; but offered it for \$50. It would have been dangerous if you didn't want the car. Buyers of cars from corner-lot markets are like lambs to be shorn.

run about six times as far as a privately owned car in the same length of time.

The Ford is the best second-hand buy on the market, and brings a relatively higher price than any other car. At the same time it is well to be able to recognize the changes in the Ford, so that one will not pay a 1917 price for a car of 1913 vintage. The best plan is to take the engine number, telephone the nearest Ford agency, and ask for the date of sale and name of the man to whom it was sold. The agency will get the information for you if it is not on hand. By that means and looking up the state registry, the life history of the car can be traced. If the seller claims to be the

original buyer, who has treated the car as the apple of his eye and washed it with toilet water and fed it only certified and sterilized gasoline, he will be somewhat embarrassed if the Ford record shows some other chap to have paid down the original purchase price. Cheap as are repairs and improved features, no one cares to pay for them and not get them.

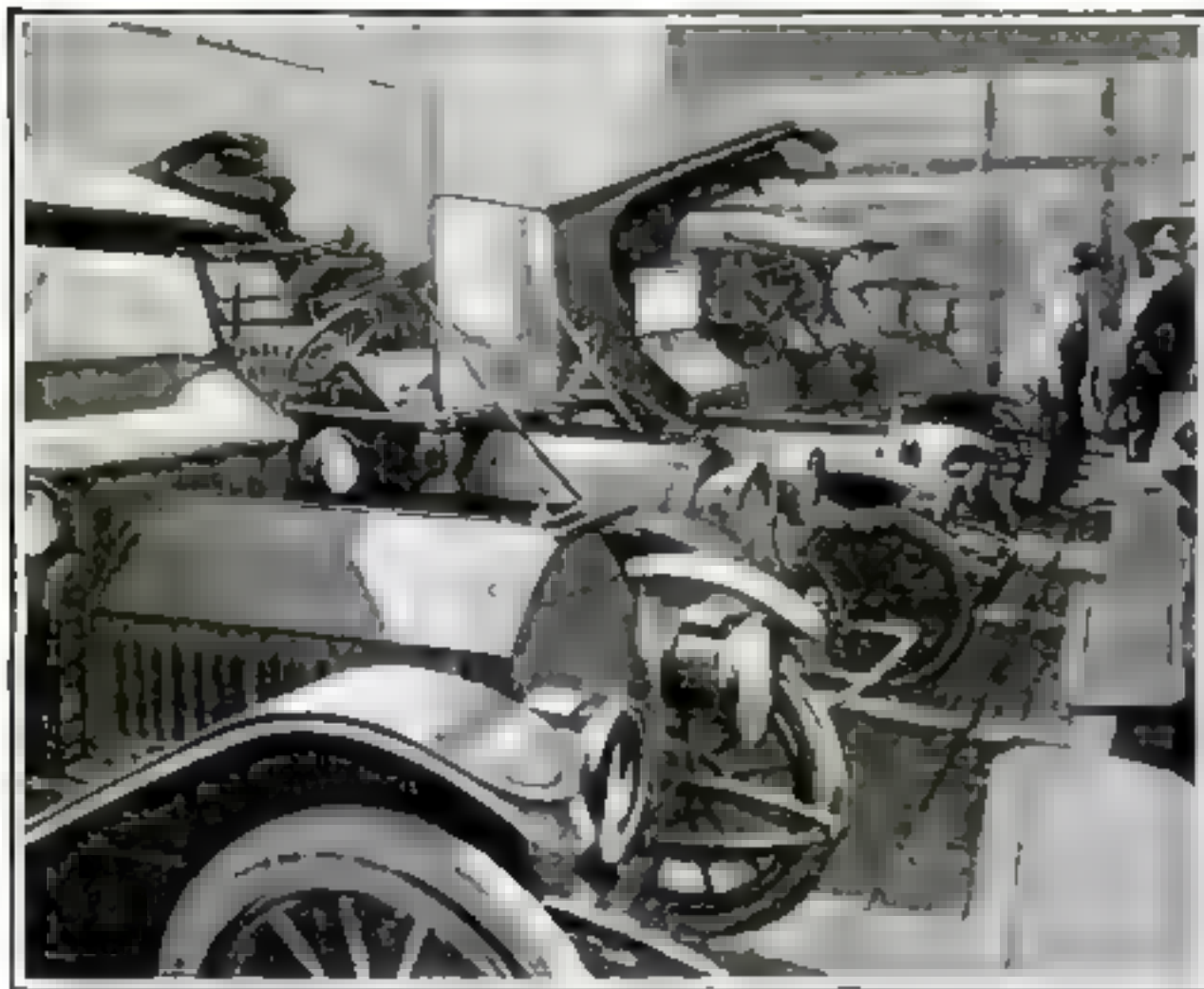


An Old-style Ford Switch and Coil Box

Learn to identify the models. It is well to be able to recognize the various Ford vintages. The Ford made earlier than 1914 would have to be an almost new car in order to be worth much over \$200. Because of the ease with which Ford parts are crossed, the unwary will sometimes be caught. Therefore, check up your Ford engine number

"You Never Can Tell"

You never can tell who's had the car, nor what he's done to it.



The Port of Ancient Cars

Some of the tricks to befool the innocent are simple, though effective. For instance, a well-worn tire held for a moment against a buffing wheel might get such a bright shine as to pass for new. Patent cure-alls are used for temporarily plugging leaky radiators

You can't tell whether he's been in a smashup and sprung the frame and wrenched the car. You can't tell whether or not there's a crack in the frame, puttied up and painted over. You can't tell the condition of the thousands of parts without having the car taken down and overhauled; and nobody's going to pay for this on a chance of a sale. If you do know the owner and his habits and so the history of the car, the tale is again different, but trust not in the yarns of the would-be seller of the motor car—even though he be usually a truthful man.

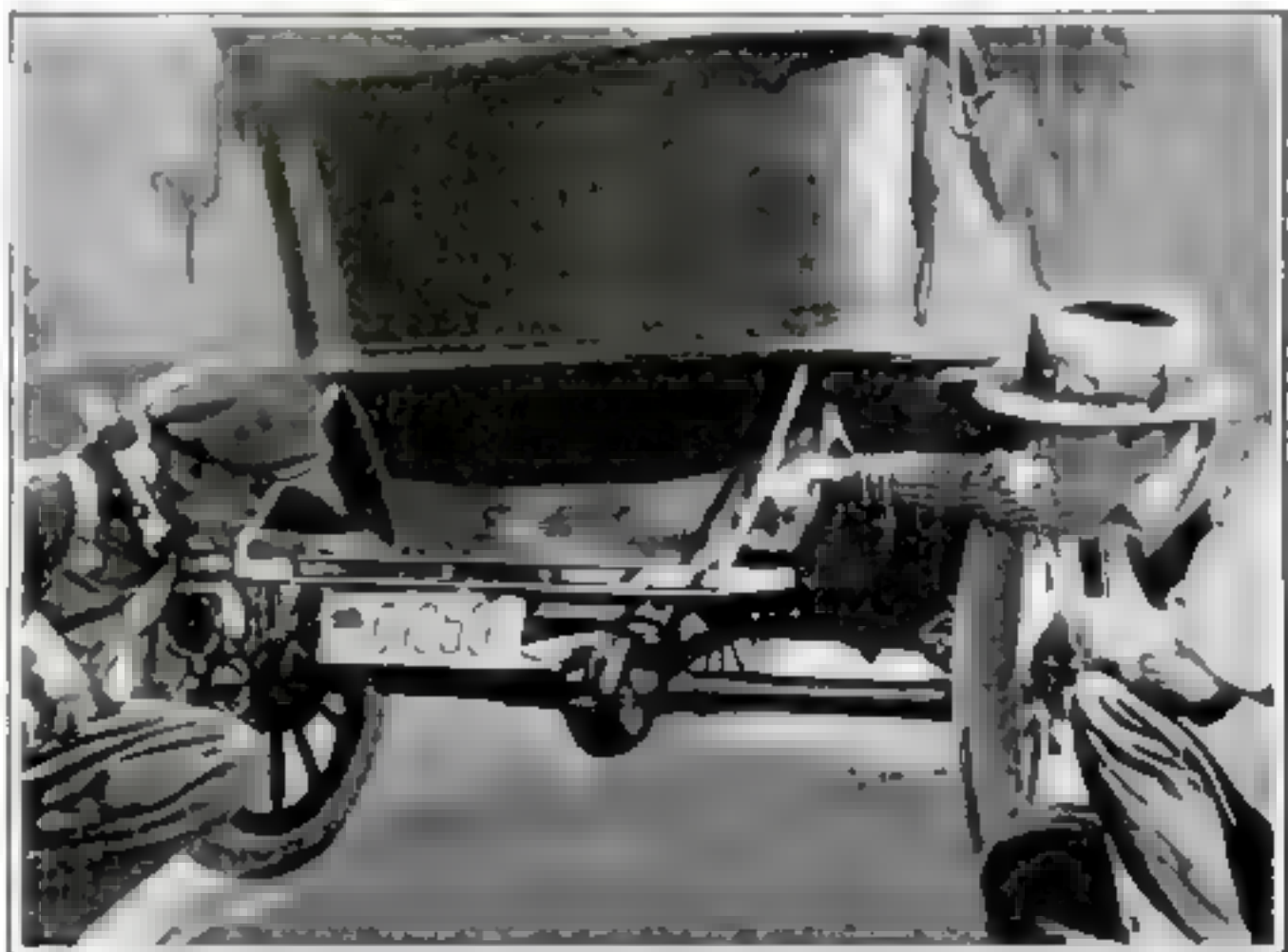
The spare tire, neatly strapped on behind the tonneau, is an attractive addition on the used-car, but before listing it as one of the desirable points, take it off and look it over.

reputable dealer, he has his choice of the two alternatives in this case—to stick a gun to the head of the seller and wring the unbiased truth from him or to take the car to the agency for the system and get their

You may find, out of sight to cursory inspection, a nice worn-out spot, or a gash six inches long.

Heavy oil and ground cork are wonderful, quieting drinks to noisy and worn and loose gears, but, unhappily, they don't occupy a high place in automobile mechanics.

The starting and lighting system of a car is another trap for the unwary. Some of the earlier systems were beautiful examples of electric abortions. Even up-to-date systems have eaten-out plates, which usually require a new battery at the purely "nominal," price of say \$25. Unless the buyer is in the hands of a



A Body and Chassis of About 1911 With a New Rear Axle Housing

The Ford is a good car to buy second hand, for the simple reason that the latest improvement made by the manufacturers can be easily installed on any old Ford. Of no other car is this true. But buy from a reputable agency that values the reputation of the car. The buyers who suffer in second-hand deals are those on the hunt for unfortunates whom Fate has robbed and forced to "sacrifice" at a ridiculous price

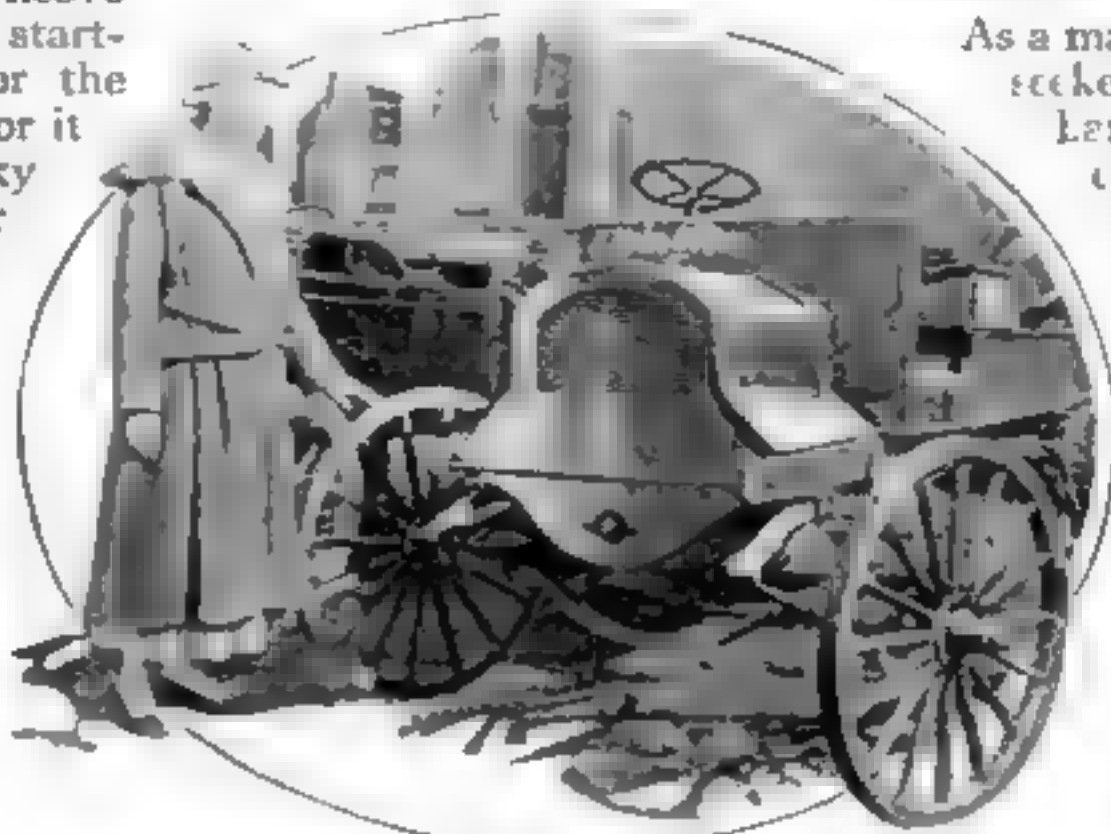
opinion on it. Names in starting systems mean nothing. Some of the great electric shops unhappily put their august names to starting systems as shoddy and unreliable as their higher priced ones are good and desirable. The Alcove may mean a fine starting system fit for the Fondulac Eight, or it may mean a junky thing designed for the famous \$695 Tincar.

There is of course a legitimate field for the sale of second-hand motorcars, and there are many responsible business men engaged in selling them. The buyers who suffer in second-hand car deals are the ones who are on the hunt for unfortunates from whom hard luck has pried loose a car—and who bite on decoy advertisements, or those who go straying along the curb markets or the corner open air emporiums with full

confidence in their own smartness. Smartness avails one nothing in the second-hand game—the other chap is always still smarter; else he couldn't make his salt.

Always Consult the Agency

As a matter of choice the seeker after the second-hand car ought to consult the agency of that car, because the agent is reliable, knows the car, and does not care to have it go out and earn either him or his firm a bad name. On the other hand, the buyer is likely to pay a bit more, because just as the agent for that make does not want to see his



How Could Any One Pass This Gem By?

Horse trading is childishly simple compared with the second-hand automobile trade. There can be but a certain number of things wrong with a horse. But the motor-car may have more vices than a herd of horses

cars drop too fast in value because of the lapse of a year or two, the agent of some other make always smiles when he can put over the sale of the opposition second-hand car at a low price, and still make some

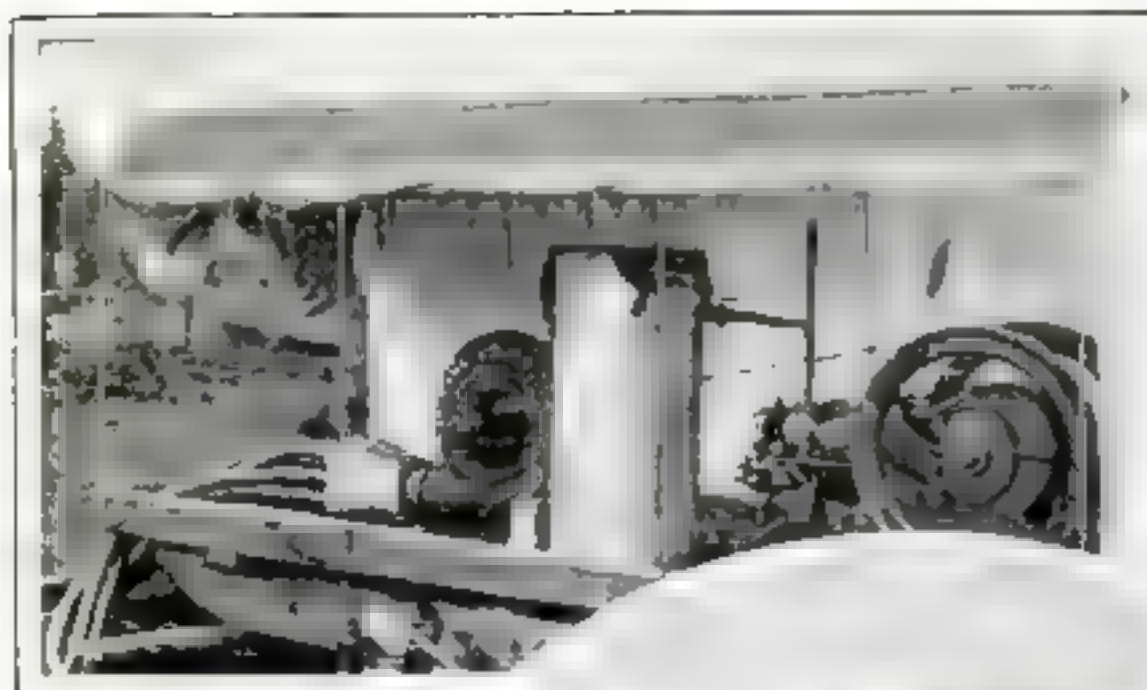
money at it. He does not forget to advertise the sale to his potential customers as showing the quick fall-off in value of the Hinkydink car. Also, as he's not crying his eyes out if the said Hinkydink car does not turn out well, he'll live up to his guarantee merely to the bare letter.

In spite of the reliability of the responsible firms that sell second-hand cars as part of their business, the person not at all versed in the motor car game would do well to get a new car, even though it fall many grades below the second-hand car.



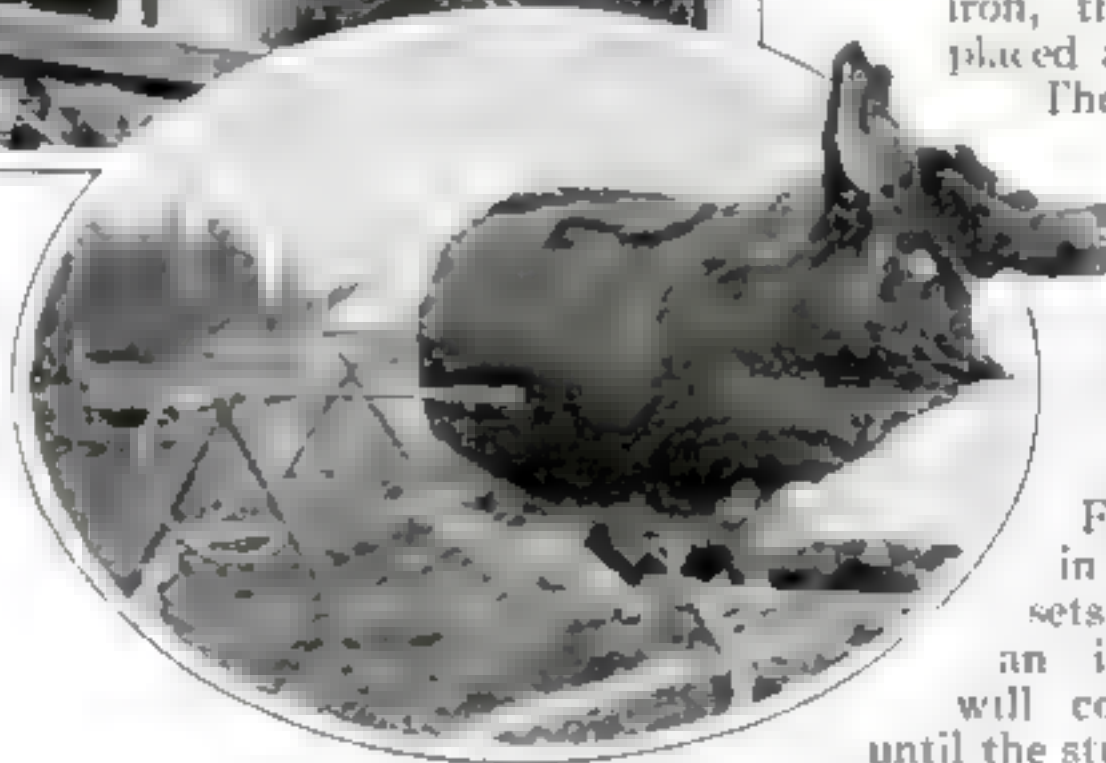
To the Junk-Pile at Last

You can junk the old car for \$100 if you can't do anything else with it. This is what happens to many second-hand "bargains." A prominent dealer in second-hand cars remarked recently: "There may be exceptions here and there, but no car made prior to 1913 is worth more than \$100"



The gasoline engine runs the blower machine which supplies air for the fire

Boring a hole in the roots of a stump. A fire is afterward started in each hole



Blowing Stumps Away with Air—An Agricultural Shortcut

THE gasoline engine will play an important part in clearing two hundred million acres of cut-over land in some thirty states of the Union. Gasoline engines have for a decade or more been successfully used as power for stump-pullers, but the new method recently evolved promises greater efficiency.

The engine is used to run what is known as the "blower machine." This usually consists of a gasoline-engine, a blower, a distributor, and several lengths of rubber hose with short lengths of iron pipe upon one end. The air in the blower is divided into an equal number of parts by the distributor and is forced through the sections of hose to the nozzle, from which it is directed upon the fire.

A one and one-quarter inch auger is used to bore a hole into the roots of the stump at a sufficient depth below the surface to permit of eventually tilling the soil, the earth having first been removed around the stump to a depth of from twelve to eighteen inches. A fire is started at the bottom of these holes by means of a hot iron, the nozzles being placed at the openings.

The air blasts keep the fire going. While these are burning, four holes are

bored two to three feet away at right angles to the first ones.

Fires are started in these. After the sets of holes burn to an intersection they will continue burning until the stump is consumed,

so that the air blasts can be removed.

One man is able to operate five to six lines of hose. As these outfits cost but three hundred to five hundred dollars equipped, and the cost of gasoline is but ten cents per hour, this proves a very economical method of clearing wild land of stumps.



The owl paper weight which holds scissors and paste

An Owl with Eyes of Scissors and Backbone of Paste

WISE old Mr. Owl may sleep during the day and fly by night in his natural element, but when the manufacturers get him in their clutches they reverse the order of things. The accompanying illustration shows what they did to a wooden owl. His back is a tube of paste; those are scissors around his eyes.

He is six inches high and the scissors that shade his eyes slip into an opening in the front. As a household pet he keeps company with the housewife's workbasket, the sewing machine and the baby's scrap-book.

Photographing Sunken Ships

A giant electric camera is used for locating sunken ships and treasures

AN electric submarine camera for deep sea photography has been invented by H. Hartman, a civil engineer of New York city. With it a sunken submarine or a wrecked vessel may be located and pictures of its condition projected for study on a screen in a few hours. Experienced divers would require days to secure the same information.

The camera consists of several cylinders connected with a steel framework. The ball at the bottom is a shock absorber, and the compartment above it contains a gyroscope to steady the apparatus against vibration. In the top cylinder is a motor which turns a propeller. This rotates the camera up on its vertical axis so that pictures can be taken in all directions. Current for the motor is obtained from above through a cable.

The tank below the propeller cylinder contains the camera, as well as the tilting, swinging and focusing apparatus. The shutter and focusing mechanism are both operated from separate switches on the surface vessel. A third switch enables the operator to swing the camera in conjunction with the light projector or independently of it. Tests carried out aboard the U. S. S. Vestal proved that the camera could take pictures of the same object repeatedly. Although some were out of focus, the majority were sharp and clear.

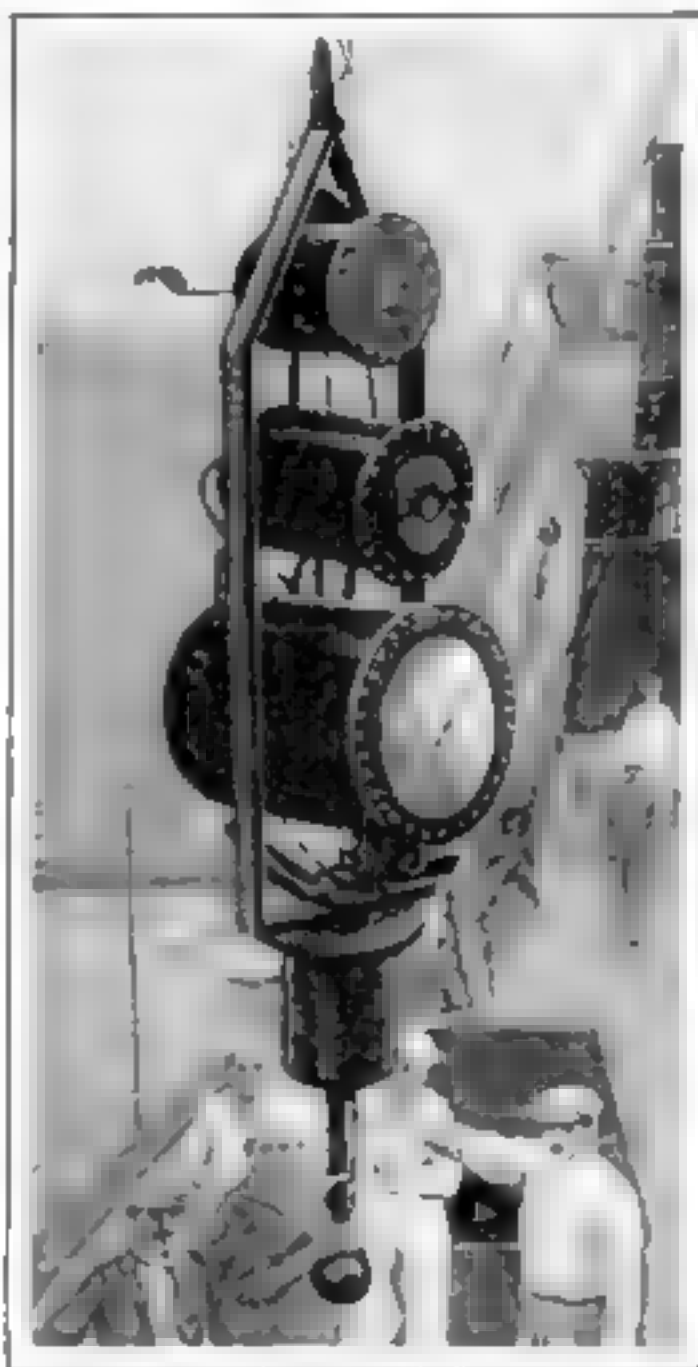
Concerning the source of light, which is contained in the largest cylinder of the apparatus, very little is known. Current for the light comes from the surface through a special cable. According to the inventor

the light projector consists of a strong steel cylinder, filled with a gas under varying pressure and having highly concentrated filaments. The light works on the principle of the ordinary incandescent bulb, so far as is known. An inner circle of transparent mica protects the heavy glass lens from the intense heat, although the surrounding water reduces the temperature considerably. A valve mechanism varies the pressure of the gas according to the pressure of the water in which the cylinder is submerged. Reserve gas is contained in a separate compartment. In addition to the live wire which acts as the source of light, there is a flexible steel wire rope to carry the weight of the entire apparatus.

On land the camera mechanism weighs one thousand five hundred pounds. Submerged it weighs about one hundred pounds. All parts are tested for a pressure of five hundred pounds to the square inch, which corresponds to a depth of about one thousand feet of water. To operate the

light projector and the several small motors, a current of approximately one hundred amperes and one hundred and twenty to one hundred and forty volts is required. When the camera is operating at a great depth under water, the voltage has to be increased to two hundred to make good the loss in passing through the long cable.

The inventor proposes to use his camera for treasure hunting, for the locating of sunken ships, and for the study of marine growths. There is no question but what the camera will be of great value in wrecking and salvaging operations.



The camera is lowered in the water to any depth up to one thousand feet. The pictures are taken and the entire camera mechanism operated from the surface by means of switches

"Blind?" No, Said the Motion Picture

Its testimony proved that a "blind" man could see, and thus reversed the decision of the court



At left: The supposedly blind man accommodates the lady by hanging her furs on the clothes line

At right: He lights a cigar from the flame of a match held in the motion-picture man's fingers



"ARE you the owner of this property?" asked a passer-by of Peter Zyla, who was busily engaged in his poultry yard on the outskirts of Chicago, negotiating a sale of pigeons to a teamster who seemed hard to suit in the matter of the color and markings of the birds

The stranger carried a camera, and while he waited for Zyla's attention he took a picture of the pigeons—and of the agile Zyla. When the birds had been delivered and the teamster had driven off, Zyla turned his attention to the man with the camera. By that time another visitor had appeared on the scene. She stood beside the man with the camera and gave Peter a smile which warmed the cockles of his bachelor heart. They wanted to take motion pictures with plenty of local color, they said. Of course Zyla consented. He was even obliging enough to take a part in the scene. He hung clothes on the line, nonchalantly lighted a cigar



Shaking hands with the director after the "play" is over. The camera gets it all

and registered just the proper amount of interest—and perhaps a trifle more—when the lady exposed the trimmest of trim ankles in ascending and descending a ladder.

But alas for the romantic possibilities! The film was later produced in court as "exhibit A" in a suit against Zyla brought by an accident and indemnity company to prove that Zyla had not been blinded, as he claimed, by the alternating heat and cold of the plant in which he worked. The indemnity company had planned the entire scene, even the purchase of the pigeons in the first act.

The State Industrial Board had decided that Zyla was entitled to damages under the Workmen's Compensation Act, but the indemnity company, which insured the plant against loss under the Act, decided to make some investigations on its own initiative before obeying the order of the Court. The case was finally decided in favor of the indemnity company.



Portions of the film exhibited in court. Zyla admitted posing but claimed that he did exactly as he was told, even in the "flirtation" parts

Making Spectacular Displays with the Aid of Toy Balloons

THE latest idea in illuminated displays for garden parties, for patriotic gatherings, and the like, is an electrically lighted balloon to be used in place of the old Japanese lantern. These balloons cannot be blown out by the wind, nor can they catch fire; they will give just as spectacular an effect as Japanese lanterns.

Ordinary toy rubber balloons are fitted with a metallic neck through which the lighting receptacle can be passed with a thrust of the hand: The electric bulb is secured on the end of a tube inside of this receptacle, and through the ring-shaped space around this tube, air can be blown to inflate the balloon. When the current is turned on, the rays of light pass through the stretched, translucent rubber with a warm glow. A number of differently colored balloons strung across a garden, or arranged in the form of a great flag would produce very spectacular effects.

Displays could be held in the country miles away from an electric light wire. Small incandescent bulbs could be installed to take the place of the larger bulbs, and they could be lighted from the current obtained from a battery or a series of batteries. Or a number of pocket flash-lights could give a pleasing effect. The bulbs could be disconnected from the flash-light and wires could connect the bulbs with the battery.

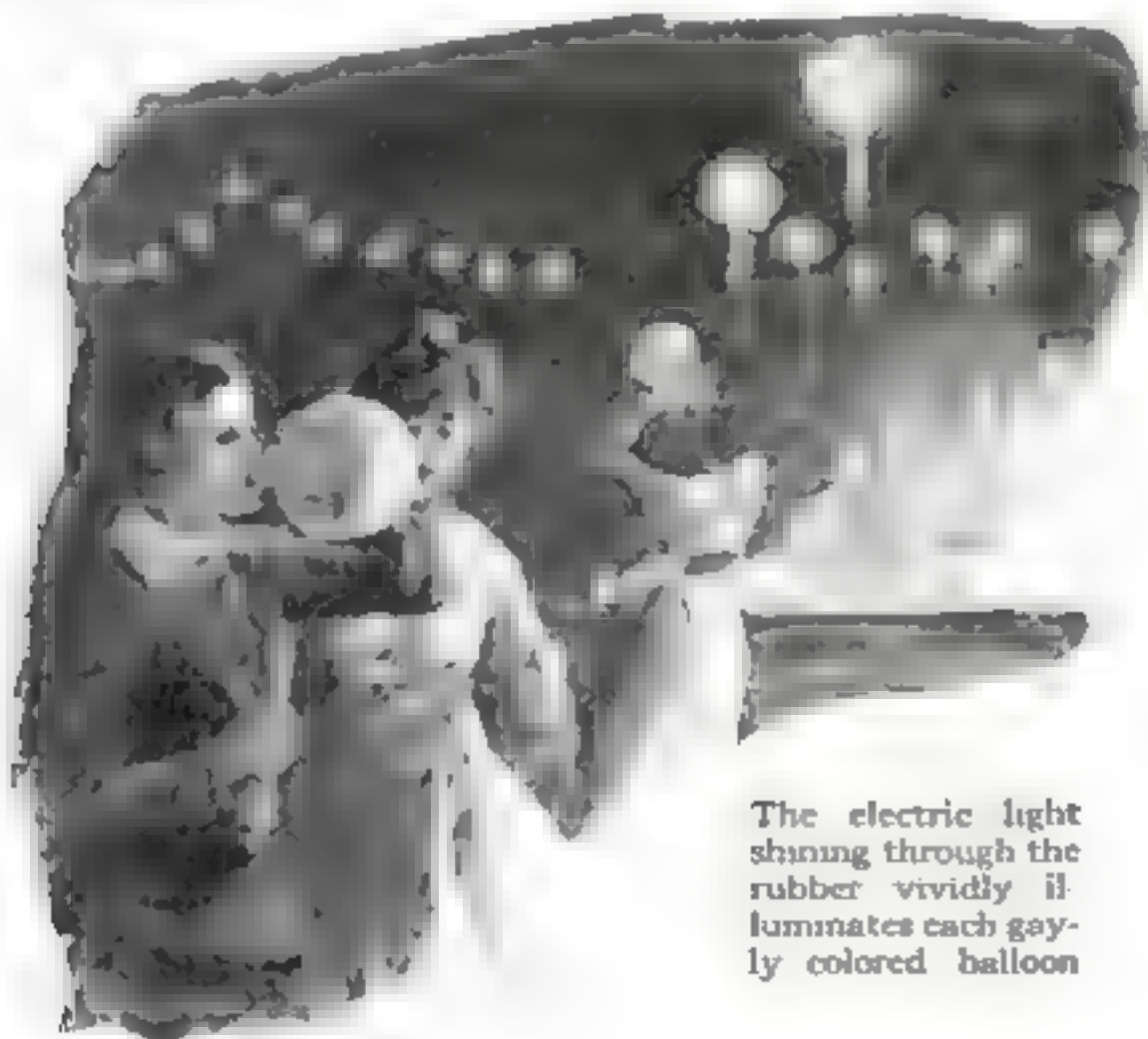


How California is teaching its outdoor population to cease killing harmless snakes which destroy disease-bearing rodent pests

Teaching the Truth About the Misunderstood Snake

IN California the Lorquin Natural History Club of Los Angeles is starting a campaign of snake education. As the accompanying photograph shows, a sign telling passersby that harmless snakes should not be killed—that they destroy disease-bearing rodent pests, is the medium used. These signs are posted in the mountains, in camping places, along streams, and in hunting grounds throughout the State. They have been read by many thousands of people.

The only undesirable snake in California, as the sign points out, is the rattlesnake. All others are beneficial and should be allowed to proceed unmolested.



The electric light shining through the rubber vividly illuminates each gayly colored balloon

Fighting a Gas Attack in the Trenches

How it feels when the green-yellow cloud steals on you

IN a new book entitled "Over the Top" (G. P. Putnam's Sons), Arthur Guy Empey, "machine gunner serving in France," takes you into the trenches and makes you feel what it is to fight under modern conditions. Here is his account of a gas-attack:

Three days after we had silenced Fritz, the Germans sent over gas. It did not catch us unawares, because the wind had been made to order, that is, it was blowing from the German trenches towards ours at the rate of about five miles per hour.

Warnings had been passed down the trench to keep a sharp lookout for gas.

We had a new man at the periscope, on this afternoon in question; I was sitting on the fire step, cleaning my rifle, when he called out to me:

"There's a sort of greenish, yellow cloud rolling along the ground out in front, it's coming——"

But I waited for no more. Grabbing my bayonet, which was detached from the rifle, I gave the alarm by banging an empty shell case, which was hanging near the periscope. At the same instant, gongs started ringing down the trench, the signal for Tommy to don his respirator, or smoke helmet, as we call it.

Donning the Gas Masks

Gas travels quickly. No time must be lost. There are only about eighteen or twenty seconds in which to adjust a gas helmet.

A gas helmet is made of cloth, treated with chemicals. There are two windows, or glass eyes in it, through which you can see. Inside there is a rubber mouth tube.

For a minute, pandemonium reigned in our trench—Tommyes adjusting their helmets, bombers running here and there, and men turning out of the dugouts with fixed bayonets, to man the fire step.

Re-inforcements were pouring out of the communication trenches.

Our gun's crew were busy mounting the machine-gun on the parapet and bringing up extra ammunition from the dugout.

A company man on our right was too slow in getting on his helmet; he sank to the ground, clutching at his throat, and after a few spasmodic twistings, went West (died). It was horrible to see him die, but we were powerless to help him. In the corner of a traverse, a little muddy cur dog, one of the company's pets, was lying dead, with his two paws over his nose.

It's the animals that suffer the most, the horses, mules, cattle, dogs, cats, and rats, they having no helmets to save them. Tommy does not sympathize with rats in a gas attack.

At times, gas has been known to travel, with dire results, fifteen miles behind the lines.

In the Folds of the Green-Yellow Cloud

German gas is heavier than air and soon fills the trenches and dugouts, where it

has been known to lurk for two or three days, until the air is purified by means of large chemical sprayers.

The author continues:

A gas, or smoke helmet, as it is called, at the best is a vile-smelling thing, and it is not long before one gets a violent headache from wearing it.

Our eighteen-pounders were bursting in No Man's Land, in an effort, by the artillery, to disperse the gas clouds.

The fire step was lined with crouching men, bayonets fixed, and bombs near at hand to repel the expected attack.

Our artillery had put a barrage of curtain fire on the German lines, to try and break up their attack and keep back re-inforcements.

I trained my machine gun on their trench and its bullets were raking the parapet.

Then over they came, bayonets glistening. In their respirators, which have a large snout in front, they looked like some horrible nightmare.

All along our trench, rifles and machine-guns spoke, our shrapnel was bursting over their heads. They went down in heaps, but new ones took the place of the fallen. Nothing could stop that mad rush. The Germans reached our barbed wire, which had previously been demolished by their shells, then it was bomb against bomb, and the devil for all.

Suddenly, my head seemed to burst from a loud "crack" in my ear. Then my head began to swim, throat got dry, and a heavy pressure on the lungs warned me that my helmet was leaking. Turning my gun over to No. 2, I changed helmets.

One helmet is good for five hours of strongest gas. Each Tommy carries two.

The trench started to wind like a snake, and sand-bags appeared to be floating in the air. The noise was horrible; I sank onto the fire step, needles seemed to be pricking my flesh—then blackness.

I was awakened by one of my mates removing my smoke helmet. How delicious that cool, fresh air felt in my lungs.

A strong wind had arisen and dispersed the gas. They told me that I had been "out" for three hours; they thought I was dead.

When the Wind Dispersed the Gas

The attack had been repulsed after a hard fight. Twice the Germans had gained a foothold, but had been driven out by counter-attacks. The trench was filled with their dead and ours. Through a periscope, Empey counted eighteen dead Germans in the barbed wire; they were a ghastly sight in their horrible-looking respirators.

He examined his first smoke helmet; a bullet had gone through it on the left side, just grazing his ear; the gas had penetrated through the hole made in the cloth.

Speaking of "Catgut"

The sheep is guilty: it is the only animal that makes a racket after it is dead

WHERE'S the cat farm from where we get our supply of catgut? The answer is: There isn't any cat farm. Cats' intestines can't be profitably utilized. If not cats, then what furnishes the raw material for musical instrument and tennis strings? The answer is. Sheep. Every part of the animal is utilized, even the soft and mellow tones of his bleating voice, which are preserved in the intestines that string the tuneful violin.

As soon as the sheep intestines are graded they are divided into narrows about eight yards in length. These are sent to the string factory, where they are thoroughly cleansed and chemically treated. It takes from twenty to twenty-four sheep to produce the strings for one tennis racket. A single violin string monopolizes the entrails of a



Drying the string on frames. This is one of the last operations before polishing, and takes from two to six days



Removing impurities from the gut strands by washing and scraping them and running them through wringers on washtubs. It requires a skilled workman to prevent tangles

whole sheep, however big.

From the time the raw material leaves the animals until it is made into strings, twelve to sixteen days are required in the manufacturing. The intestines of some sheep are lighter in color than others, but the light or white strings do not possess any better tone quality or durability than the darker ones.

After the gut is split by running it over a safety-razor blade, the strands go through another machine which removes impurities. Following this they are repeatedly run through wringers on washtubs. From four to fifteen of these strands are used for one music string, being spun into strings, twisted, and polished off with emery paper.

Up with the Storm Signals!

The language of the weather bureaus of the world is one of flags, lights and cones

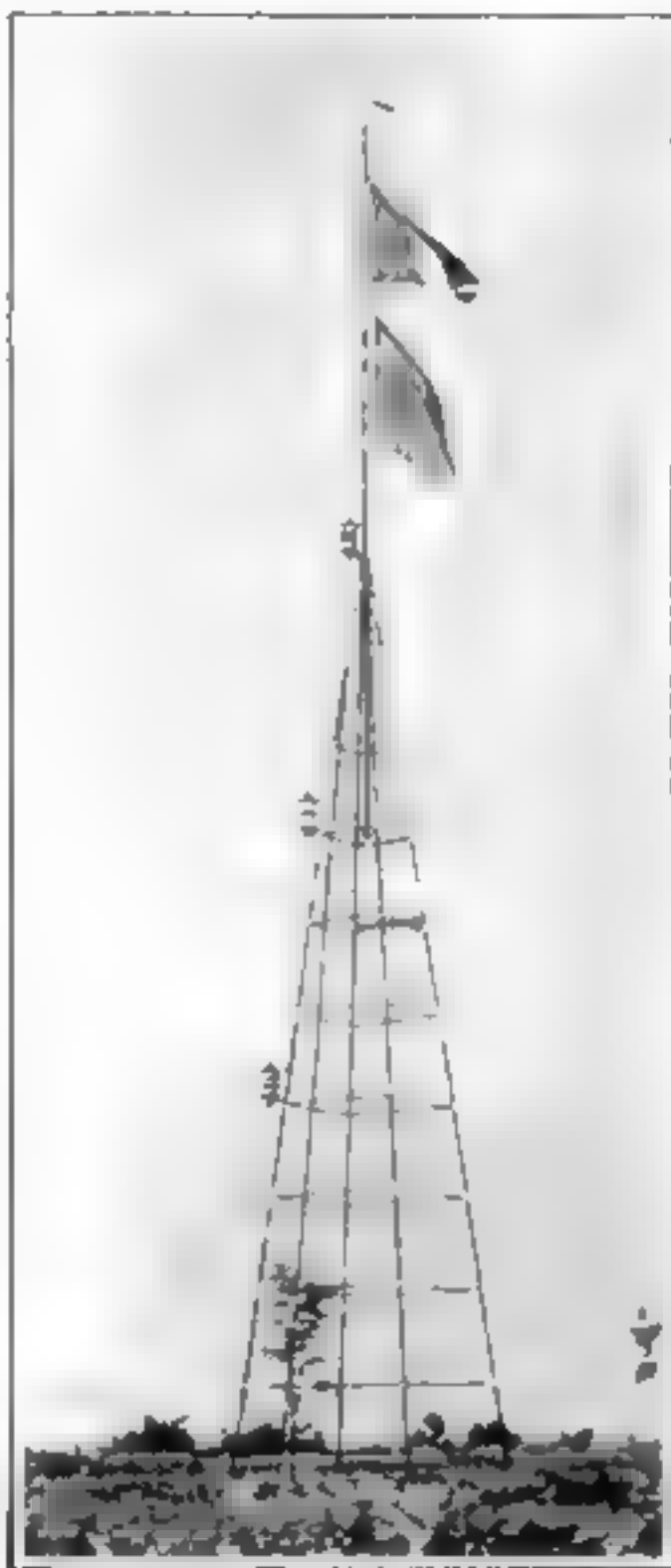
THE invention of the electric telegraph made it possible for meteorologists to gather reports of simultaneous weather observations over extensive areas, enter the data on charts, prepare forecasts and storm warnings, and issue such information to the public; all within a period of time short enough to make the predictions useful for practical purposes.

Telegraphic weather services date from the middle of the last century, and at first they were designed especially for warning mariners of approaching storms. In the days before "wireless" the problem of transmitting such warnings to ships at sea could be solved only by the display of conspicuous signals at nu-

merous points along affected seacoasts.

Several forms of signal were evolved. In the British Isles Admiral FitzRoy introduced the use of canvas cones and "drums" (i. e., cylinders), which, seen from any direction, presented the appearance of solid triangles and squares against the background of the sky. At night they were replaced by groups of lanterns. The drum, indicating winds of varying direction, has since been abandoned, and the British now use the cone alone, pointing up or down, for northerly or southerly gales, respectively.

One of the earliest storm-signaling devices was a form of semaphore, known as the "aeroclinoscope," used in Holland. The position of the arm of the semaphore indicated the region in which the barometer was low; i. e., the storm center. The American storm-flag—red with a square black center—was adopted by the United States Signal Service (the predecessor of the Weather Bureau) in 1871. This signal was later amplified by the addition of red and white pennants, to show the



A standard storm-signal tower of the U. S. Weather Bureau. At the top of the mast is a weather vane



NORTHERLY GALES



SOUTHERLY GALES



GALES FROM N. E.



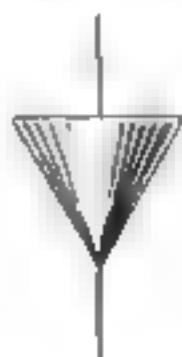
GALES FROM S. E.



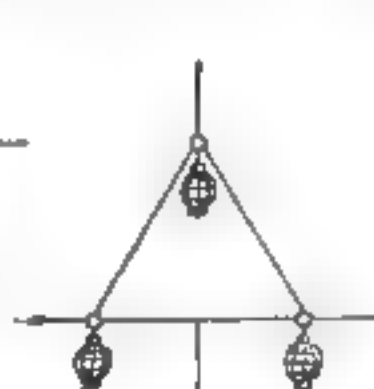
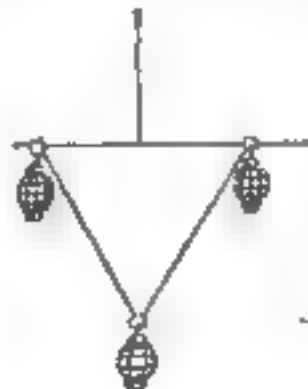
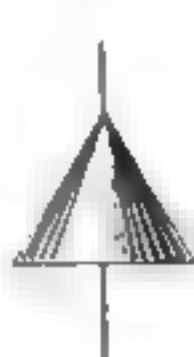
HURRICANE



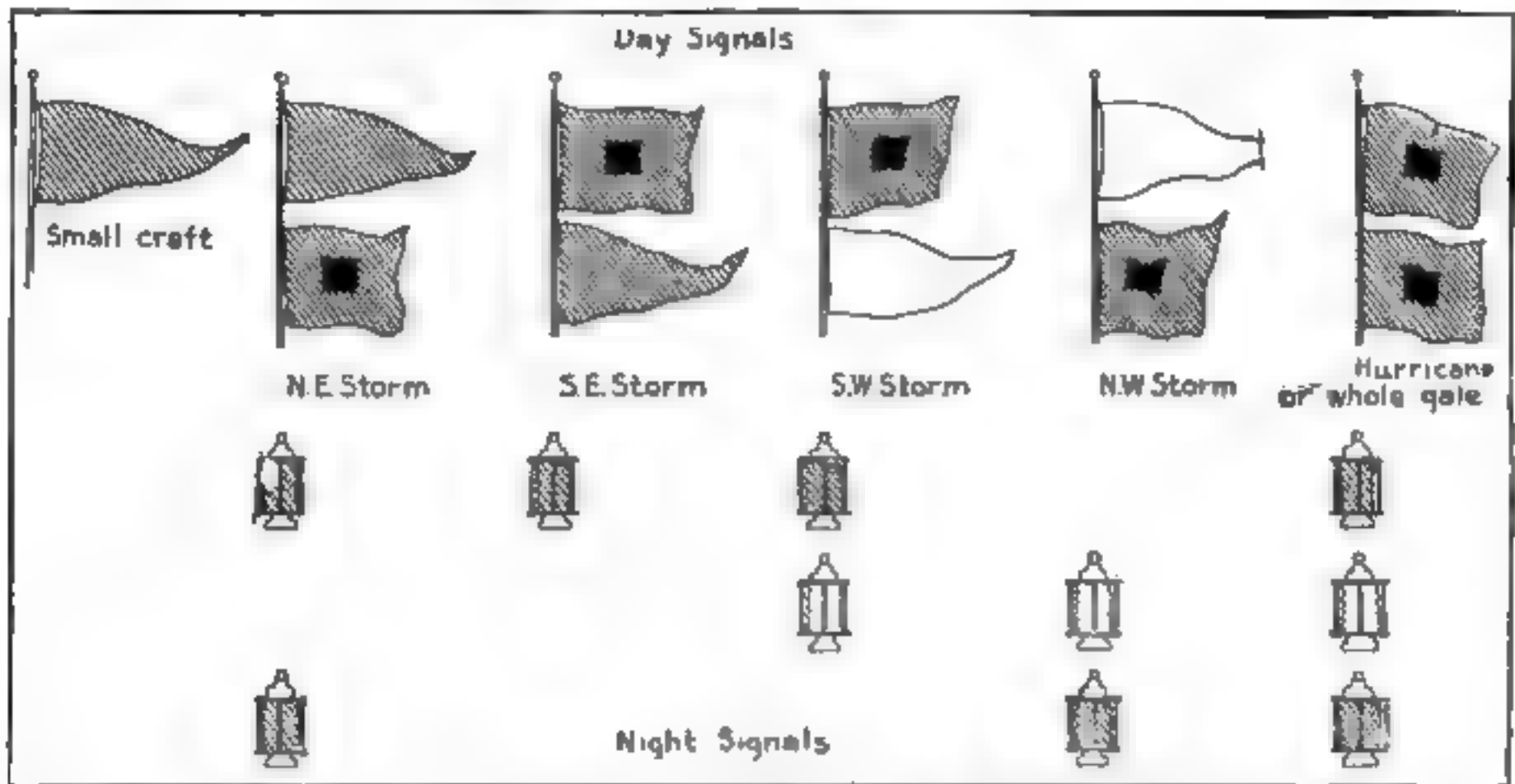
A combination of cones which is seen in most French charts



Cone pointing down indicates southerly gale; cone pointing up, northerly gale



At night triangular groups of lanterns of the same significant arrangement replace the cones



Storm signals of U. S. Weather Bureau. The night signals shown above are displayed only on the Great Lakes

expected direction of the wind at the beginning of the approaching storm.

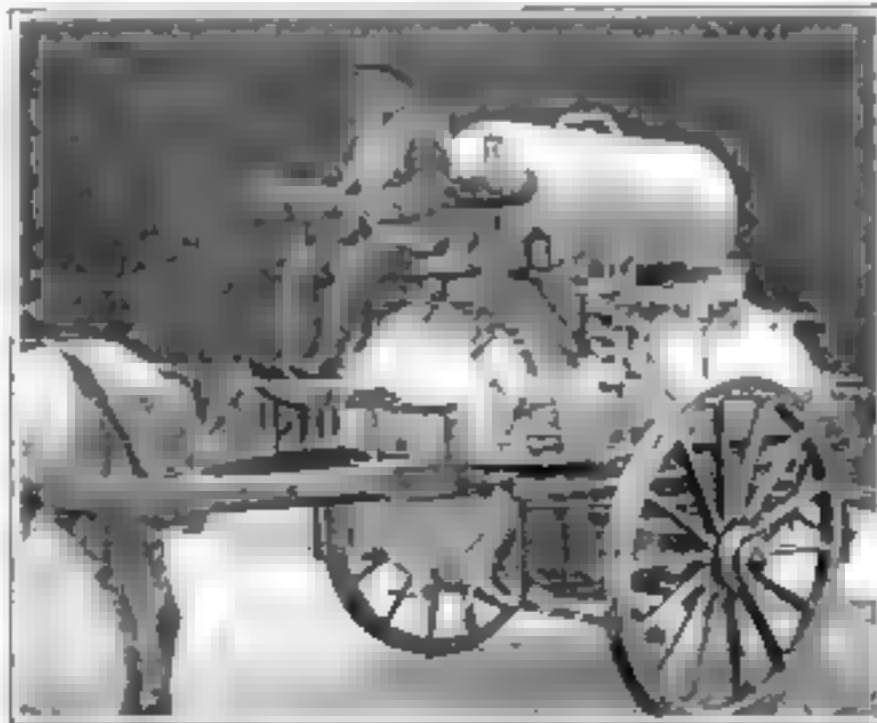
In the year 1909 an international commission met in London to consider the introduction of a uniform system of storm signals for all countries. The system eventually recommended consists of combinations of cones, as shown in the annexed figure; but it will probably be many years before the international signals come into general use.

At the present time some thirty or forty systems of daytime storm signals are in use in different parts of the world. The most elaborate of these are found in the Far East, and serve to indicate, not merely the fact that a storm threatens the place where a signal is displayed, but the existence of a typhoon anywhere in the neighboring seas, its location, and the direction in which it is moving. All this is accomplished by means of solid symbols (cones, balls, diamonds and squares) displayed at both ends of a yard arm and at the summit of a mast, in a conspicuous location on the coast.

A Huge Clothing Sterilizer on Wheels for the Armies

THE barber's eternal question, "Hot towel, sir?" is answered in a novel way in France just now. A giant sterilizer on wheels takes care of the towels and other articles of the men who return from the fighting front and puts them through a steam bath which both cleans and disinfects them. Thus the spread of disease is prevented.

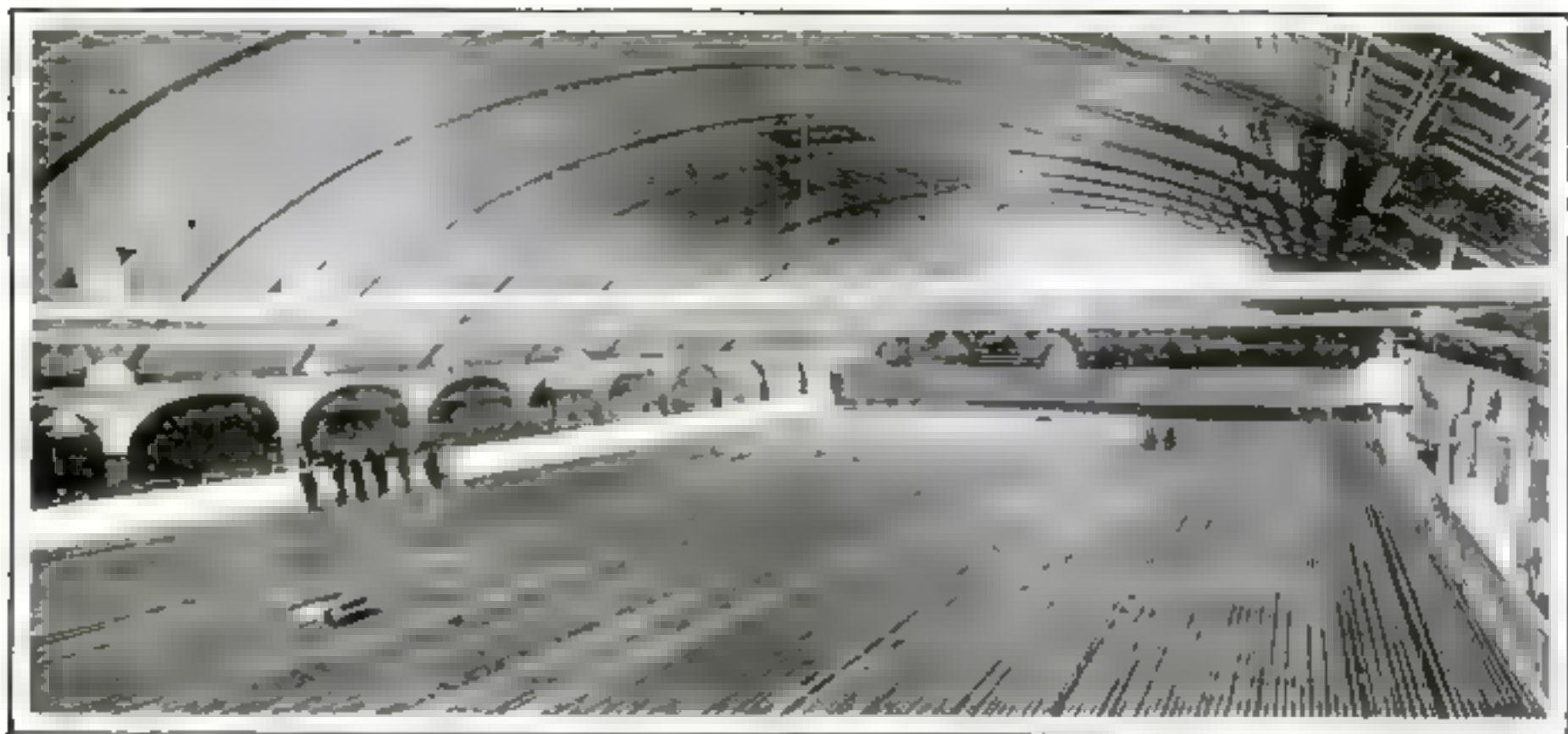
However, France does not keep her sterilizers at home. She sends them directly back of the first-line trenches in villages where the troops are permitted to bathe occasionally.



French Official Photo

A sterilizer for cleaning and thoroughly disinfecting the clothes of French soldiers when they return from the trenches

From the photograph it will be seen that the larger tank of the two is the steam chamber, while the smaller tank contains water. The water is heated by gasoline or kerosene. The sterilizing chamber is large enough to accommodate nearly a hundred soldiers' suits. It takes about an hour to thoroughly clean a uniform, but proportionately less for towels.



More than two thousand pieces of old boiler tubing were welded to make ten miles of continuous pipe flooring without screwed fittings or joints

Welding Ten Miles of Pipe for a Skating Rink

TO make ten miles of continuous pipe was the problem that confronted the builders of a large ice-skating rink at San Francisco. Investigation had shown that in many ice rinks where ammonia systems were built with screwed fittings, leaks frequently developed in joints supposed to be leak-proof and trouble-proof. The result was shut-downs for repairs and a subsequent financial loss to the management.

Oxy-acetylene welding not only made the San Francisco ice rink leak-proof but it made possible a remarkable saving in the purchase of pipe. Instead of using new pipe, fifty-five thousand feet of two-inch "used" boiler tubing was purchased at a saving of twenty per cent over the cost of new galvanized pipe. The floor is two hundred and ten feet long and ninety feet wide. The welded portions number considerably more than two thousand. This plan eliminated all fear of leaks and proved entirely satisfactory.

A Convenient Device for Keeping Your Razor Blades Clean

IT takes nearly as much time to remove safety razor blades, clean and replace them after using, as it does to shave. And if a man's in a hurry, there is an imminent danger of cutting the towel—or his fingers—in the operations.

A device which will save both your time and your temper and eliminate the danger of cutting your hands, is shown in the accompanying illustrations. Two pieces of spring brass, which are riveted together, hold a rubber pad on one end and a felt pad on the other. Two strokes on the rubber pad will clean your razor blade, while two more on the felt pad will dry it perfectly, leaving it clean and bright as when new.

The convenience of this device makes it unnecessary for anyone to neglect to clean and dry his blades, however great may be his hurry. This means that the blades will be kept from rusting, and will last considerably longer in consequence.

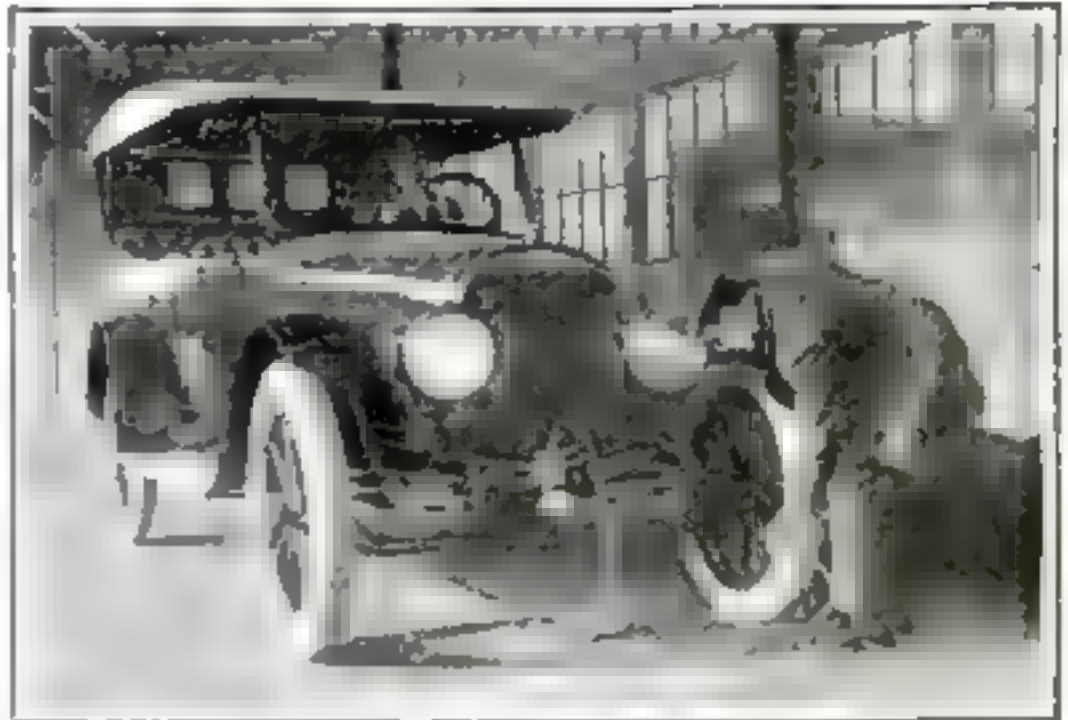


The rubber and felt parts of the device for cleaning and drying the razor blades

Maybe you have special needs. Write to the editor about anything within the scope of the magazine. He will be glad to help you.

A New Zinc Product Which Is a Substitute for Tinfoil.

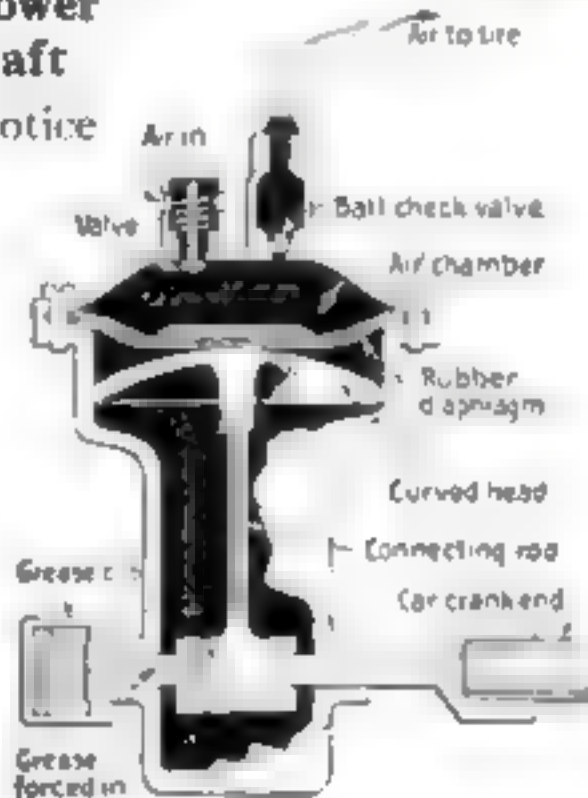
FROM Breslau, Germany, comes a report of a substitute for tinfoil which has been successfully manufactured from zinc by a German experimenter. The zinc product is so similar in appearance and general characteristics to the tinfoil that the two are scarcely distinguishable. The manufacturer claims that the zinc foil will answer every purpose for which tinfoil is ordinarily employed.



This Tire Pump Gets Power from the Engine Crankshaft

AUTOMOBILISTS, take notice of the tire pump illustrated. It fits any make of car and particularly cars which were not originally fitted with power tire-pumps under the engine hoods. It is merely slipped over the end of the engine crankshaft extending out in front of the radiator. By starting the engine and attaching a hose from the pump to the nipple, the tire is inflated in a few moments. This done, the pump is removed just as easily and put back in the tool box until required again.

It is impossible to pump oil into the tire with the air. Oil rots rubber inner tubes. No oil can find its way to the tire because a tight, vibrating diaphragm is used. The air is sucked in on one side of the diaphragm and then forced out on the same side, in which no oil is used. There is only one lubricated part of the pump, and that is the lower end of the connecting rod bearing which causes the diaphragm to vibrate. This bearing is oiled with grease from an outside grease cup.

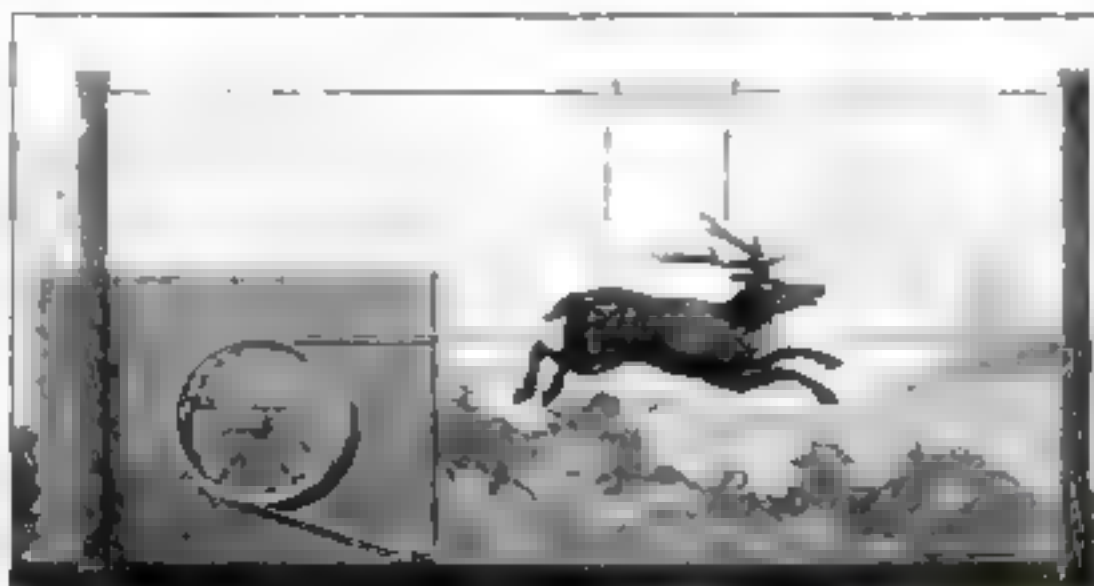


At left Part cross-sectional view of the pump, showing the cylinderlike casing with a rubber diaphragm held between top and cover. This diaphragm is vibrated up and down by means of a lower semi-spherical cup fastened to the top of an eccentric connecting rod around the shaft of the pump which is connected with the engine crankshaft. The air is sucked in through a small valve in the cover on the down stroke of the rod and forced out on the upstroke as the diaphragm is also forced up. A check valve in the outlet valve prevents the air from backing up. Above: The pump in use on the car

Moving Targets to Quicken the Eye and Steady the Aim

RIFLE clubs are adopting the moving field targets so popular in British shooting ranges to quicken the eye and add zest to rifle and revolver practice.

The "deers" used are generally five feet long and are constructed of heavy plaster-board, painted a light brown and suspended by two wires which ride on a trolley wire which is about thirty yards in length. The driving power is furnished by a flexible cable attached to the front and rear of the deer.



A hand pulley improvised from a bicycle wheel is used to drive the target by means of a flexible cable

Aim and Pull the Trigger to Photograph an Enemy from the Air

THE scout in an airplane must have something better than his eyes. Anti-aircraft guns compel him to fly at not less than six thousand feet. The ground below is so far away that it is impossible to distinguish make-believe guns from real guns, or to identify the thousand and one concealments practiced by the enemy.

As a result the camera has taken the place of the airman's eyes—an especial stereoscopic camera built directly in the machine itself. Dozens of pictures reveal the enemy's secrets with astonishing frankness. During one of the engagements at Arras, no less than seventeen hundred stereoscopic photographs were made in a single day. William F. Folmer believes that better results can be obtained if the camera is operated by hand. And so he has adapted the well-known focal-plane shutter, with which his name is identified, to a camera which, as shown in the accompanying illustration, is handled like a rifle. The operative mechanism of the camera is exactly like that of the focal-plane shutter cameras well-known to most amateur photographers. Mr. Folmer's camera is provided with a regulation pistol-grip and trigger. When the trigger is pulled, not only is the exposure made, but a fresh section of the film is advanced for a new exposure.

The material of the camera is waterproof. So that if the aviator and his instrument should fall into water, his valuable films would not be damaged.

After a roll of film has been exposed, how to get it back to headquarters with-

out landing is often a problem. For this purpose a very ingenious method of using a parachute has been developed. Cylindrical pasteboard containers are provided with an umbrella-like parachute folded inside. By pulling a wire with a hook on the end to which the folded parachute is attached, the parachute can be pulled out, and then, due to the tension of the wire framework, automatically spread out. Observers stationed below pick up the film and send it at once to headquarters for development.



Simply pull the trigger and take a picture

The camera is of the fixed-focus type adapted for long distance photography. A special telephoto lens, as it is called, is employed, which is 14 inches from the plate and which gives results that would be obtained with ordinary lenses 24 inches from the plate. The box itself is 22 inches long, 6 inches square at one end, and 5 inches square at the other end. It weighs 10 pounds and is waterproof.

Making a Mule Push and Pull at the Same Time

GEORGE L. COVERT, crippled so that he must always use a wheel-chair, is traveling from New York to the Pacific coast in a queer way.

He sits in his wheel-chair and is pushed ahead by means of a shaft of his own invention. The shaft is fastened to the back of the wheel-chair and also to a mule's collar. Behind the mule is a small two-wheeled wagon in which part of the Covert family rides. Hence the mule pushes the chair and hauls the wagon at the same time.



George L. Covert wants to travel to California from New York. This is how he is doing it, with a caravan of his own invention

Sowing Tree Seed in the Snow

As the snow melts the seed sinks deeper and deeper and finally buries itself in the ground

TO keep our national forests, which are scattered from Alaska to Porto Rico, up to standard, twelve to fifteen thousand acres have to be reforested or planted each year. The bare lands must be made productive and the thin stands of wood must be improved. To do this requires an immense amount of labor.



Two strips of plowed ground form a guard to prevent a fire from spreading. No grass is allowed to grow in the plowed strips



Sowing Douglas fir seed in the snow. When the snow melts the seed settles in the ground and is soon buried in a bed of earth

One of the accompanying photographs shows a company of men "broadcasting"—that is, sowing seed by casting it broadcast, over the snow in the Siuslaw National Forest, in Oregon. The seed they are sowing is Douglas fir. As the snow melts the seed sinks deeper and deeper and when the snow disappears entirely the seed is already covered over with sufficient dirt to give it a bed in which to grow. The chief disadvantage of the method is that the seed is conspicuous on snow and likely to be eaten by birds. After a few days of sunshine it soon disappears from view.

Another interesting part of the work is

the building of fire guards to assist in protecting plantations. In the Nebraska National Forest two strips of plowed ground each twelve furrows wide and separated by a strip of unplowed ground about two rods wide are constructed. The plowed strips are harrowed when necessary to keep down subsequent growth and the intervening strip of unplowed ground is burned over. The strips arrest the fire when a high wind is blowing.

An ordinary fire-break costs about fifty cents per mile per furrow. In heavy timber the cost would be as much as fifty dollars for the same distance.

Let the Birds Save a Billion Dollars a Year

A quail can eat 2,000 Hessian flies in a day and a prairie chicken four times as many. Let them keep insects off the farm

By Robert H. Moulton

CHARLES E. WHITE, of Chicago, grain broker during his business hours and bird protector during his leisure, believes that it is possible to lop a billion dollars off of the Nation's cost of living by the simple expedient of feeding insect-eating birds. Farmers and fruit growers of this country are losing over \$1,000,000,000 a year by reason of the destruction of birds in the last thirty years. The cotton growers are suffering a loss of \$100,000,000 annually because of the ravages of the boll weevil. The reason is that quails, prairie chickens, meadow larks and other birds have been swept away by gunners.

Grain growers are losing over \$100,000,000 a year on account of the chinch bug and another \$200,000,000 a year on account of the Hessian fly. Both are very small insects, almost microscopic in size.

Over 24,000 chinch bugs weigh one ounce. Nearly 50,000 Hessian flies weigh an ounce. A quail killed in Kansas and examined by a government expert had in its craw the remains of over 2,000 Hessian flies it had eaten in one day. A quail killed in a potato field in Pennsylvania and examined by a government entomologist had in its stomach the remains of 126 potato

bugs. The farmers of the Northern States are paying out \$16,000,000 to \$20,000,000 a year for Paris green to put on their potato vines.

The quail is the most valuable insect-eating bird of its size. Each adult quail is worth \$25 a year to the farmer on whose land it lives. The prairie chicken consumes about four times as many insects each day as the quail does, because it is about four times as large. In a lesser degree, our small birds, almost without exception, are responsible for the destruction of many insects each day.

Mr. White plans to save all insect-destroying birds and prevent the destruction of \$1,000,000,000 worth of grain and foodstuffs each year.

When ten years ago Mr. White bought a five-acre wooded tract near Kenilworth, Chicago, he found many



An open-air cafeteria to encourage the colonization of insect-eating birds



A winter birdhouse. The wind catches the vanes and turns the house broadside to it, protecting the birds from storms

birds on the place. But during the winter most of the species migrated. He then began to experiment to see how many he could induce to remain all the year round.

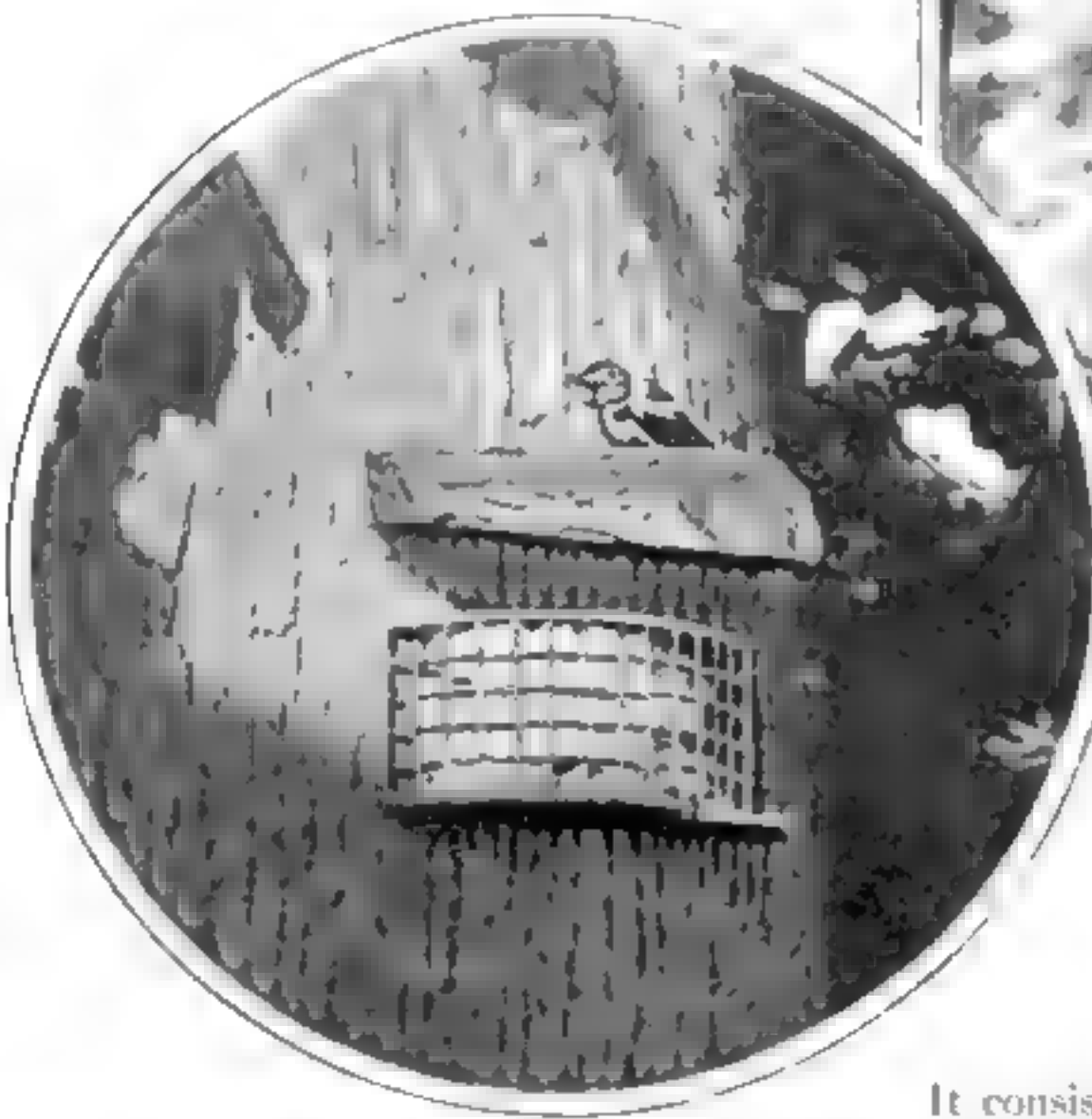
He built a few bird houses around the place, gradually increasing the number each year. He also built a number of bird baths. The rustic bird houses, which are preferred by the birds, he made of wood with the bark on.

It was not long until the number and species of birds about the place increased amazingly. What was equally important, many which had been regarded as migratory remained the year round. Last winter he induced such birds to stay as the chickadee,



A wren house with a suet basket underneath. Note the windows and blinds of the house

Birds like suet. To prevent the larger ones from getting it all, screened suet boxes are used



white-breasted nuthatch, downy woodpecker, brown creeper, cardinal, blue jay, hairy woodpecker, white-throated sparrow, pine siskin, fox sparrow, white-crowned sparrow, goldfinch, tohee, robin and other species.

The work of feeding the birds has resulted in the construction of a special design of food box to hold suet. Mr. White discovered that when suet was placed on the ground or limbs of trees without protection the bigger birds crowded out the smaller and weaker ones and took possession of the entire supply. In order to prevent this the box now used was constructed.

It consists of a curved piece of steel that protects the bark of the tree upon which it is hung. The front is covered with a strong wire net that is sufficiently coarse to admit the bills of the hungry birds, but too fine to allow them to remove all of the suet supply at once.

A fresh water bath, according to Mr. White, is the best thing on earth to attract birds. Some of his baths are on stands and some are built in the ground. These baths, he says, have undoubtedly drawn more birds to his place than all the food he has offered them. He soon found that some species of birds are afraid of the ground baths, but will bathe in those that are raised, and vice versa.



The tooth-like points of the harrow brake dig into the ground and hold the car in place until the engine can be started again.

A Harrow-Like Brake for Mountain-Climbing Automobiles

MANY deaths have occurred in mountain touring due to the engine going dead while on a steep grade because of the driver's attempt to go up in a higher gear than he should. When the engine stops, the car slides backwards and in many cases goes over the edge of the road if the brakes are not in the best possible condition and the driver does not apply them without losing his head.

Built along lines very similar to the harrow used by farmers and drawn over plowed land to level it and break the clods, the novel brake device shown in the accompanying illustration is designed to prevent automobiles used in mountain touring from running backwards

down steep roads should anything go wrong with the regular brakes.

It is the invention of George Stickney, of Oregon. It consists of a harrow-like frame suspended from a cross-wise shaft pivoted to the chassis frame directly back of the engine and lowered into contact with the road by means of a system of levers controlled by a hand lever and notched quadrant in the driver's cab. The sharp, tooth-like points of the harrow dig into the ground and hold the car in place until the engine can be started again and the clutch thrown in. They also serve to hold the car until it gets under way. This eliminates the danger of starting under the same conditions without the device, in which case the conventional brakes must be released before the clutch is thrown in. This might allow the car to gain sufficient backward momentum to prevent the engine from starting and permit the car to drop off the road if the brakes cannot hold it.

A Water-Cooling and Purifying Pipe for the Fastidious Smoker

THE smoker will welcome the appearance of a pipe which not only cools the smoke before it reaches the pipe stem but purifies it as well. Clarence J. Graham and Joseph A. Farris, of Chicago, Ill., are the inventors.

The secret of the cooling and purifying pipe is the bowl of water situated directly below the bowl which contains the tobacco. A metal tube extends from the tobacco bowl down into the water bowl. At the top of the water bowl is an outlet pipe. By puffing the pipe, smoke is drawn through the metal tube, down through the water and out of the outlet pipe through the stem. Thus all smoke passes through the bowl of water before it reaches the smoker's mouth.

Removable bowl



The smoke is purified and cooled by passing through a bowl of water before reaching the stem

Gold-Plated Teeth for Sheep Are Common in Scotland

THE sheep of the western islands of Scotland are almost as stylish as the dogs that ride in automobiles on our own Fifth Avenue, in New York city. The canine aristocrats have occasional cavities in their teeth filled with gold, but the Scottish sheep have their entire set gold-plated before they have any chance to decay. The gold-plating is due to gold dust in the soil. As early as 1536 Hector Boece, Bishop of Aberdeen, speaks of the remarkable appearance of the sheep that roam "the golden mountain" in central Aberdeenshire. Their wool is yellow, their flesh is red, flecked, as it were, with saffron, and their teeth are the hue of gold, he says.



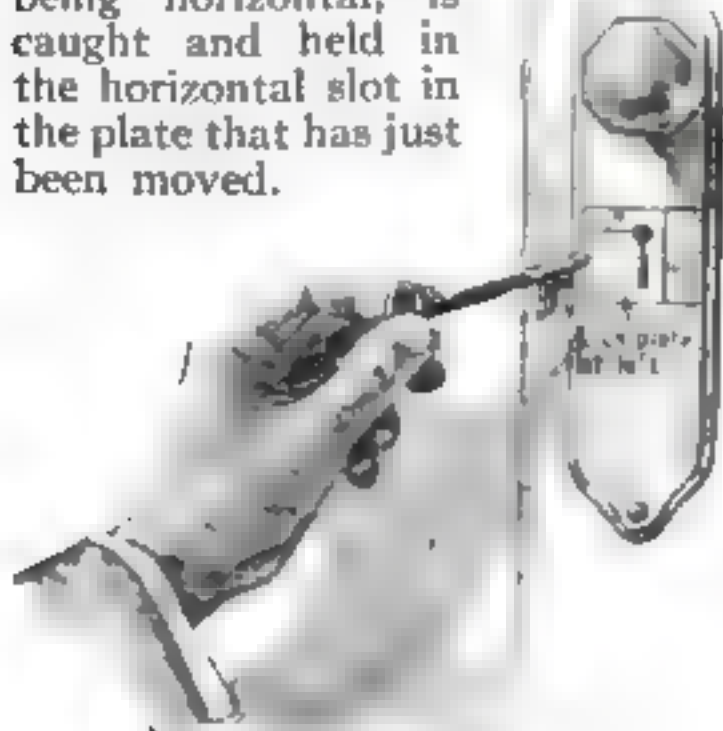
The combination suit which is an excellent substitute for waists and skirts or shirts and pantaloons



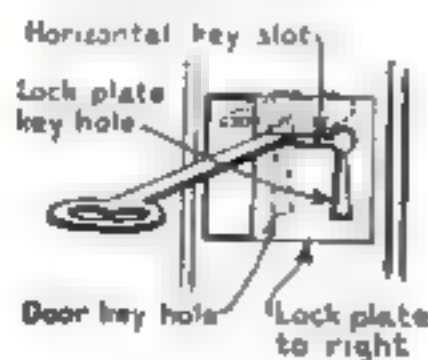
To Keep Out Burglars, Leave Your Key in the Door

ED. E. CURTISS, of Spokane, Washington, has invented a key-hole guard. Leave your key in the door at night, and it will be impossible for anyone to insert another key in your door.

The guard can be fitted to any door. It consists of a plate which slides horizontally just in front of the body of the lock, and in the inner side of the door. On locking the door from this side, this plate is moved by turning a knob. The shank of the key, being horizontal, is caught and held in the horizontal slot in the plate that has just been moved.



At left A plate slides just in front of the body of the lock and on the inner side of the door



The shank of the key is caught in the horizontal slot and held so that nothing from the outside can move it

The Overall Has Entered the Fashion Sheets

FOR the first time, perhaps, since the days when Indian women tilled the land while their lords and masters hunted or fished or fought, American soil has felt the pressure of the feminine foot on spade and fork. It has been no light, inefficient pressure, either, nor is it hampered by skirts.

The approved costume for the really-earnest farmer, whether man or woman, is a combination overall suit, which not only

affords perfect protection but is comfortable and easily put on. The illustration above shows the different styles applicable for women's wear. Those for men are very similar in design. They are made of khaki, denim or other suitable material. Even the children are not left out. Their suits are made exactly like those of the adults, since their bit in the farm work is equally as important. Khaki hats meet the approval of the youngsters for topping off these utility suits. Women prefer the old-fashioned sunbonnet.

A Lift Deck for Automobile Freight Cars

It doubles the automobile capacity of a car and does not interfere with the shipping of other goods

IN shipping automobiles in car load lots at the present time, a temporary deck or floor is built within the car at the time of each shipment. On this, one row of automobiles is placed above another row loaded on the main floor of the car. In this way the capacity of the car is practically doubled. But this method of utilizing space is expensive and it injures the car to have the decks continually installed and removed. Consequently the automobile shipper is up against a serious problem.

Joseph C. Youngblood, of Atwood, Kansas, has invented a lift deck which seems to meet all requirements. The mechanism necessary to operate the deck will in no way interfere with the shipping of goods other than automobiles. The deck can be lowered to the car floor so that automobiles can be loaded upon it with ease. It can then be raised to its elevated position and automobiles loaded into the lower portion of the car without interfering with it.

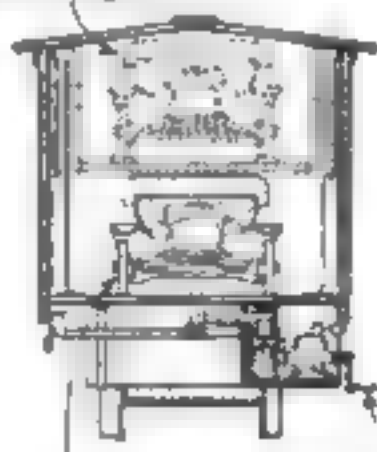
The lift deck is raised by means of pistons traveling within four cylinders. The lower ends of the four cylinders extend below the car floor and are connected with a pipe that extends to a tank containing oil and a pump.

An electric motor and the pump which it operates are contained in a separate compartment carried under the car floor. The oil supply tank is situated next to the pump.

When the deck is to be raised the motor is started and the pump forces oil from the storage tank into the pipe line and thence into the cylinders to force the pistons upward. When the deck, with its load of automobiles, has been raised to its uppermost position, pins are inserted in the cylinders to hold the deck permanently in position. This prevents any possible back-flow of the oil from the cylinders and relieves the cylinders and pipe line from continued pressure. When the deck is to be lowered, the pins are removed to permit the free movement of the piston rods.

After reaching its destination the car can be unloaded without any additional equipment or tools. The automobiles on the car floor are first removed and when they are all out the upper deck is lowered and the cars on it removed as were the cars on the deck floor. Spaced floor plates support the automobiles while they are being shipped, but wooden beams can be substituted. The supply tank, pumps and motor may be placed in any part of the car that is convenient.

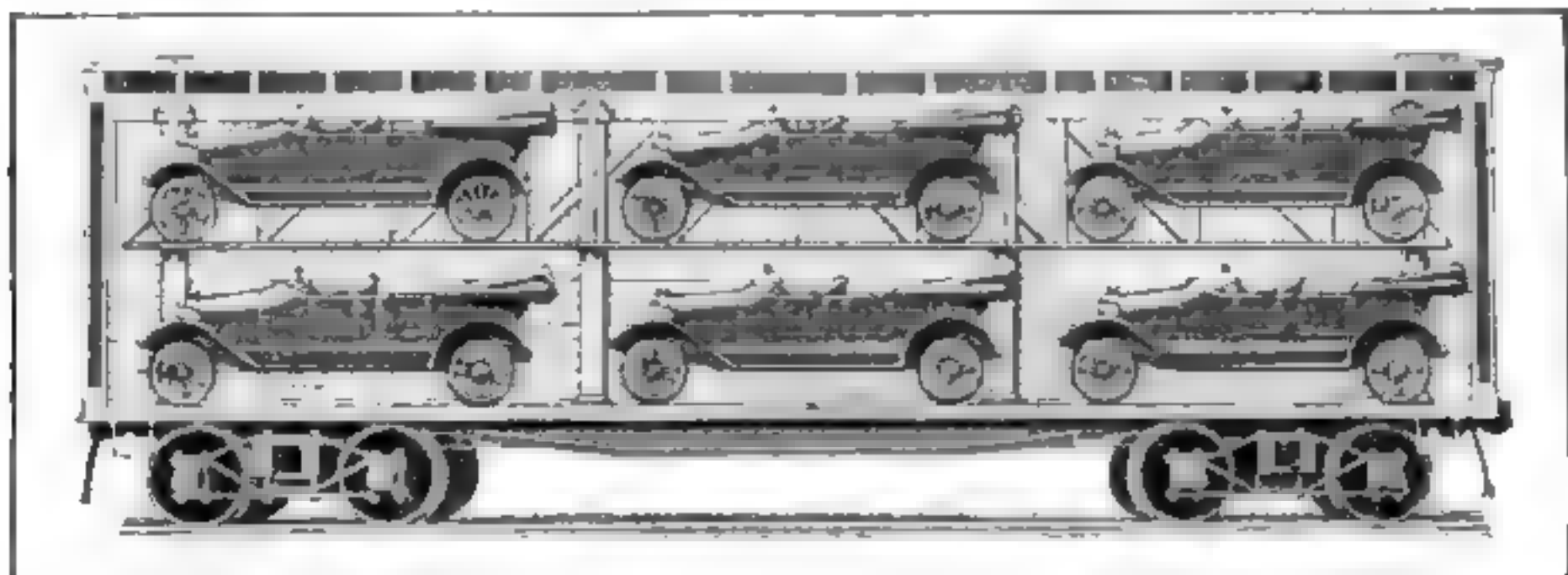
Position of automobile when raised on lift deck



Automobile under raised deck

Lifting mechanism

The upper lift deck for automobiles and the mechanism that elevates it



The lift deck takes the place of the expensive temporary upper deck and does not interfere with the carrying of goods other than automobiles. It can be raised or lowered in a minimum of time

You Can Roll This Can Without Spilling the Garbage

IT looks as if the ideal garbage can had been invented at last. William Dowie, of New York city, is the inventor and his can is about everything that a garbage can can be.

It is dustless, odorless and noiseless. You can turn it over without spilling it because the lid is clamped tight across the top. The lid prevents flies, dogs, cats, mice and rats from touching the contents. It is strictly a non-disease spreading can.

There are rubber bumpers on the top and bottom which make it practically noiseless when it is being rolled across the sidewalk or street and dumped in a wagon. Furthermore, the rubber prolongs the life of the can, protecting it against rough handling.



The lid on the can prevents the contents from spilling and keeps flies from spreading disease

Drilling with This Electric Drill Is Like Shooting a Pistol

ELECTRICITY is rapidly taking all the back-breaking exertion out of every kind of work. It all the inventions based upon it turn out satisfactorily and as many more are brought out in the future the old axiom about earning our bread by the sweat of our brow will lack pungency. Look at the electric drill shown in the accompanying photograph, for

instance. It is patterned somewhat after a pistol and by its use a hole can be drilled in iron or steel with the ease of shooting a pistol.

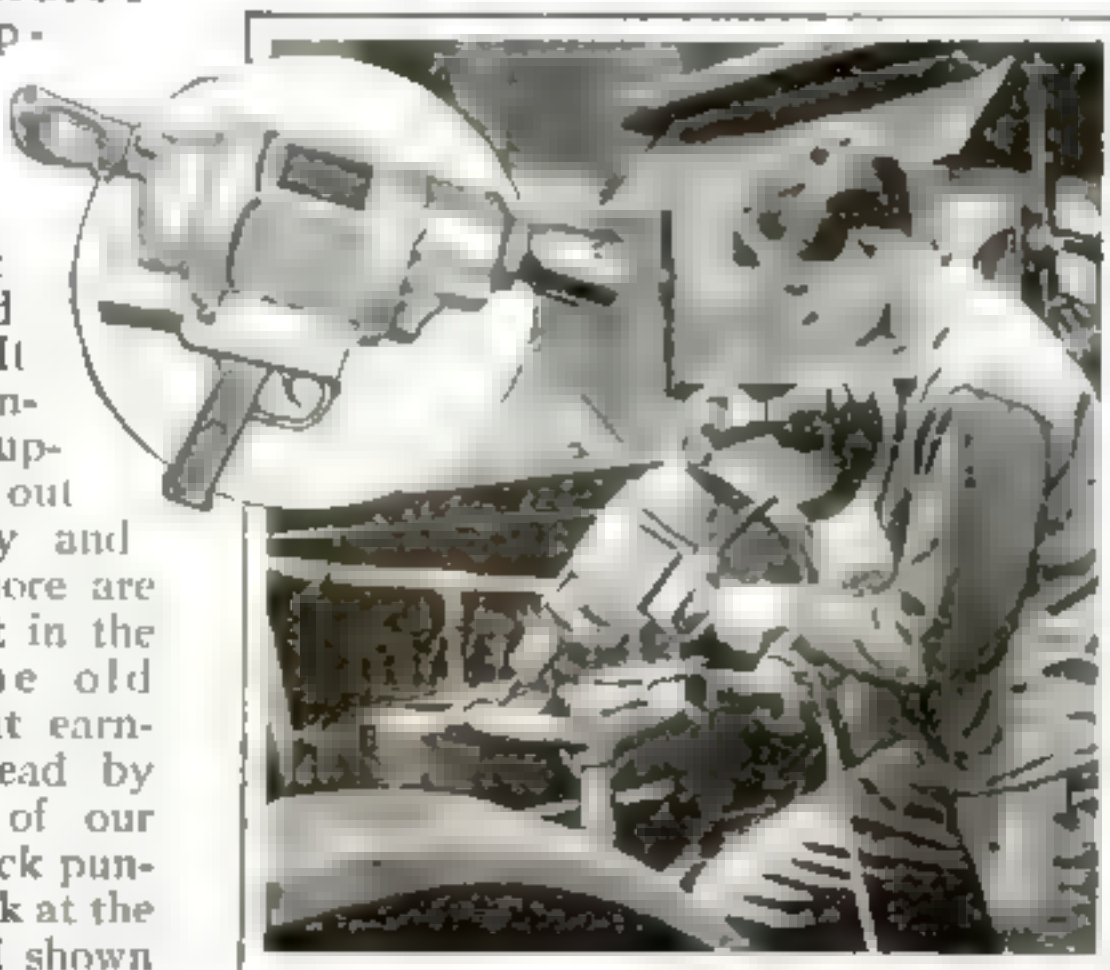
This electric drill has a trigger-like on-and-off switch which makes it possible to handle the instrument without fatigue. The trigger switch also prevents the breakage of drill bits for the reason that it is possible to control the drill without releasing the grip to the slightest extent and allowing the weight of the device to sag on the drill bit.

The workman instinctively pulls the trigger to shut off the current when the drill bit passes through the metal being drilled, thereby saving current expense. The chuck spindle can be adjusted to fit all sizes of bit stocks so that the drill can be used in nooks and corners where there is not much room, and in hard-

to-reach spots, as shown in the accompanying illustration.

The cover of the motor armature of the drill is perforated for cooling to prevent overheating. The drill weighs a trifle over thirteen pounds complete and drives the bit at nine hundred revolutions per minute with no exertion on the part of the operator.

The ease with which it is operated is not the only attraction of the electric drill, however. The hole is made in a small fraction of the time required by the ordinary method and is perfectly clean and true.



"Shooting" a hole into a hard-to-reach spot with an electrically operated pistol-shaped drill



Even in the dark you would know that the bottle above with its skull and cross bones mold contained poison

The points over the cork of the bottle on the right would warn you that you had the poison bottle in hand



These Bottles Warn You That They Contain Poison

IN a bulletin on poisons, issued from the Surgeon General's Office at Washington, D. C., it is stated that every year five thousand people, on an average, take poison by mistake. The Surgeon General recommends that poison be sold and kept only in bottles of distinctive shape. The bottle shown in the illustration seems to be ideal for the purpose. Even little children and the most illiterate adults usually know that the skull and cross-bones indicate danger.

The pattern is molded deep

in the glass, so that when the bottle is taken up at night in the dark it is easily distinguished by the sense of touch. There is a smooth space left on the side of the glass on which labels telling the kind of poison that is contained in the bottle may be pasted. But should the label drop off or become defaced, the fact that the contents of the bottle are poisonous will be obvious from the shape and design of the bottle itself.

Another design is the invention of Worth R. Barringer, of Colorado. A metal clamp fits around the neck of the bottle and projects two pointed segments over the cork, holding it in place and by a slight prick warning the person attempting to withdraw the cork that the contents of the bottle are poisonous.

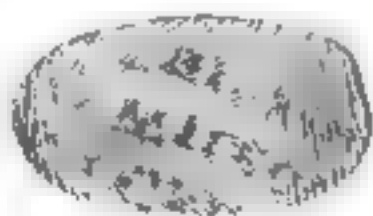
Is This the Secret of Curious Lettered Finger Prints?

IN the April issue of POPULAR SCIENCE MONTHLY, on page 517, there appeared an article describing a curious finger print. A National Guardsman had his finger print taken and was surprised to see the letters "U O P L E" on the ball of his right fore-finger. He was unable to give a reason for their presence; furthermore, he did not know they were there until an imprint was taken of the finger.

Now comes an explanation of the method by which the mysterious letters were imprinted on his finger. W. K. Evans, director of Evans University, in Chicago, Ill., offers us the following:

"In order that you may enlighten those who may have wondered how the lettering got on to the print, I send a finger print with the words 'Chicago' and 'Wilson' plainly visible on the ridges.

"A rubber stamp was pressed down on the glass slab after the ink had been rolled on it, and the tip of the finger had been lightly inked. The inked finger was then pressed down on the lettering of the stamp. This made the imprint.



A finger print showing imprint of the words "Chicago" and "Wilson"

Kitchen Luxury—The Ivory Pie-Crust Trimmers of New England

NEW ENGLAND has long been famous for pie, which, if it is not the actual staff of life, at least runs the other food contributions a close second. In the old Dartmouth Historical Museum in New Bedford is a curious collection of quaintly carved ivory instruments known then as now, in the old New England households as piecrust crimpers.

New Bedford was at one time the greatest whaling port in the world. A whaling trip is by no means short. The average trip was one year. Ofttimes three or four years passed before the whaler would reach his own shores again. No doubt with thoughts of home came visions of the pies for which their housewives were famous; for most of the curious pie-crust crimpers were carved by the whalers during their idle hours at sea from the ivory which was part of their catch.

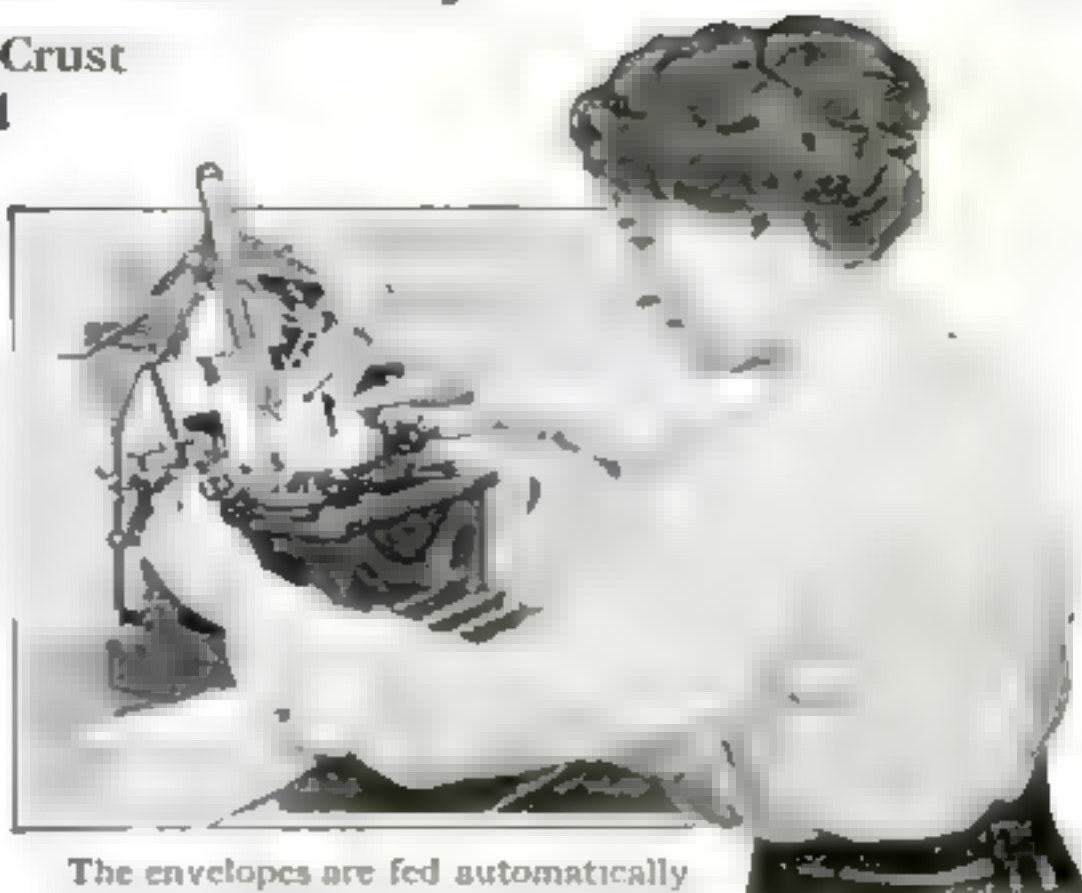
The pie-crust crimper consists of a handle and wheel which has a crimped edge so that when it is run around the sheet of thin pie crust dough it cuts the dough out with a fine serrated design. Trimmers were used not only to cut around the border of the pie but also back and forth along the top of the crust. In baking, the openings spread, leaving beautiful leaf and flower designs on top of the pie.



Photos © Brown and Dawsons



Ivory pie-crust trimmers made by the old whalers who used to put in at New Bedford



The envelopes are fed automatically by a turn of the typewriter platen

Let This Automatic Device Feed Your Envelopes

A SIMPLE machine designed to increase the efficiency of typists by automatically placing envelopes in proper positions in typewriters has just been put on the market. The instrument consists of a framework attached to the machine and operated by the ordinary space-line lever. With one turn of the typewriter platen, the addressed envelope is forced up and out from the roll and the next one simultaneously and automatically placed in the proper position to receive the next address.

From four to six envelopes can be addressed per minute by an amateur typist, thereby allowing the higher-priced stenographers to concentrate on letter-writing; or the time saved will permit the same stenographer to do more work in the same time as formerly.

The automatic envelope feeder consists of a magazine holding one hundred and fifty envelopes and a framework having four steel fingers, two above the others. The upper ones, one on either side, press down on the uppermost edge of the envelope and force it behind the platen, adjusting it in a straight position. The two lower fingers engage the envelope inside of the flap and push it from the magazine down behind the roll, after which the address is written.

It Has Stopped Raining? Then Pack Your Water- proof in Your Bag

ARAIN coat suitable for the traveler weighs only thirty-two ounces and folds into a neat envelope when not in use. It is also useful to the motorist and to others who feel the need of being protected against inclement weather and wish to avoid carrying heavy garments. Though light the rain coat makes a smart appearance, and it is so small when folded that you can pack it away in your handbag.

A special bag is provided for it, however, which is neat and inconspicuous.



When not in use the rain coat folds into a neat envelope

What You Will Need When You Go to the Training Camps

IF you happen to be one of the fortunate ones chosen to be transformed into officers at one of the training camps, your first impulse will probably be to purchase a nifty uniform, two or three pairs of classy looking shoes and a supply of varicolored ties and socks. But nip that impulse in the bud. There are few things you will really need at camp and most of these will be supplied you by your loving Uncle Sam; or if you must purchase them, you can buy them from the Government for much less than from the trade.

Bomb Exits for America's First Portable Hospital

IN the heart of New York city there are a number of trim frame buildings which form America's first portable hospital. The buildings are constructed so that they can be taken apart and set up in another city within two days. All windows are made so that the air is admitted over the heads of the patients, preventing a draft, and bomb exits are provided every few feet. The bomb exit is a section of the wall which swings out and drops.

The things you will really need and which the Government does not supply are towels and plenty of handkerchiefs. It would be advisable, too, to take with you a pair of slippers and a light bathrobe. A raincoat

might be made to serve instead of a bathrobe and answer its own purpose as well. Have a light roll stocked with your own private toilet articles, and supply yourself with a fountain pen and colored crayons for map-drawing. Cross entirely off your list of essentials the civilian suit, neck-ties and white shirts. You will have no time to wear anything but your uniform.



The bomb exit which affords a quick escape for both the patients and the nurses of a war hospital

Machinery Made from Scraps

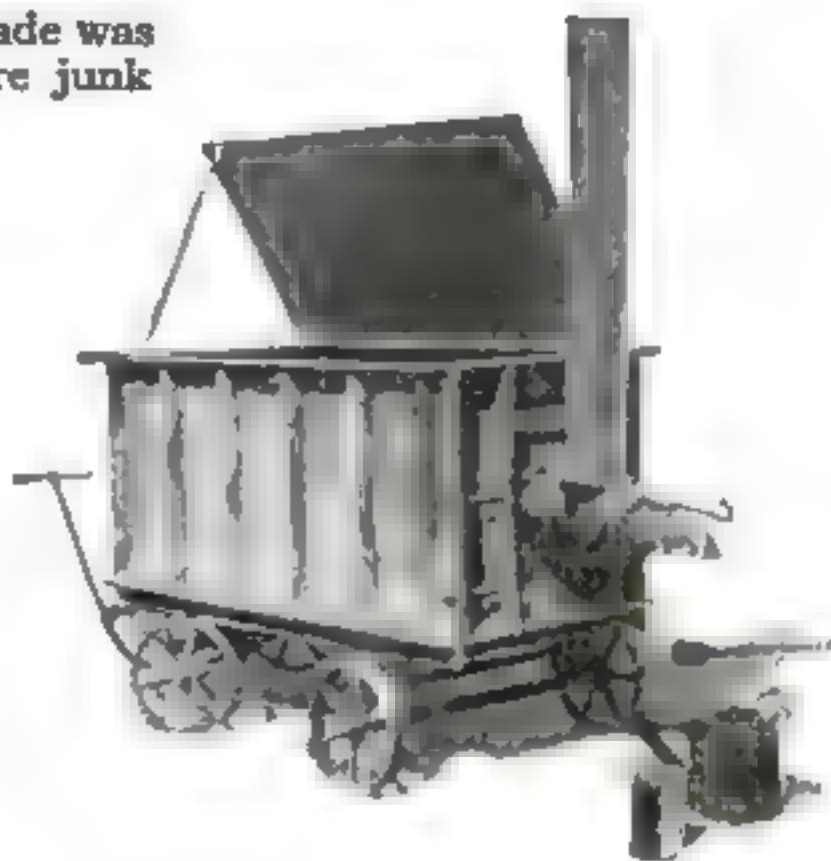
The material from which it was made was strewn about camp, and was mere junk

WHEN the time came to pave the top of the Kensico Dam, in New York, the superintendent, George H. Angel, didn't go to the extra expense of purchasing new paving equipment. He took a hurried inventory of the odds and ends of machinery that lay about the construction camp and decided that he could make some machinery of his own out of them.

Our illustrations show what he did with a few pieces of discarded pipe, wheels, nuts, bolts, etc. A roller was made by fitting an old belt-pulley with a wrought-iron handle. The asphalt-heater was made out of an old steel form that had been used for casting concrete blocks. By riveting in a false bottom near the middle of the form, cutting a door in the lower half at one end and riveting on a hinged cover and smoke stack, the heater was ready for use. The asphalt was placed in the upper half and a wood fire was built underneath the false bottom.

The mixer for the mortar was made by joining flanges to the ends of a short length of riveted steel pipe and by bolting cover plates to them. An axle with paddles ran through the center and the propelling force was a small motor placed at one end. The machine was mounted on an old wagon body.

The roadway across the top of the dam

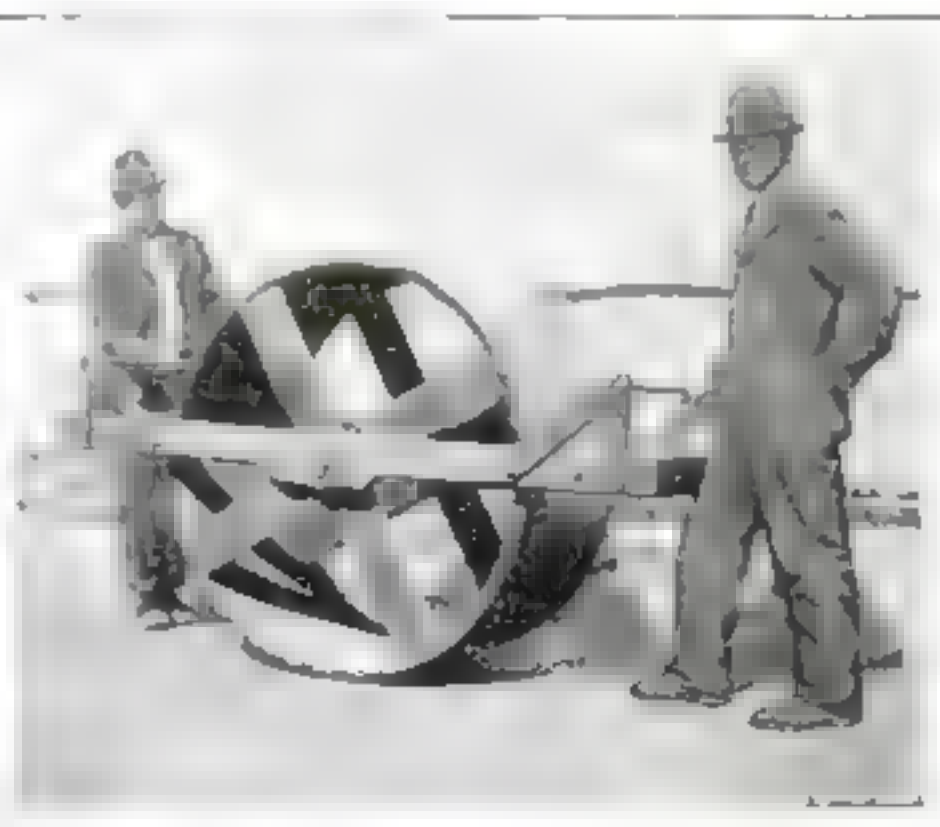


An old steel form for concrete blocks was converted into a heater

is twenty-one feet wide and two thousand, five hundred feet in length. There is a cement sidewalk on one side and a concrete curb on the other, each about eight inches above the surface of the roadway gutter. The forms for the concrete were all made from scrap material which was readily obtainable at the camp, and a locomotive crane was used to transport the cement from the mixer to the roadway, where it was spread by hand. The machinery made from odds and ends gave as good service for the purpose as new machinery.



The mixer for the mortar is a complex affair. It is mounted on an old wagon body



The roller was made by equipping a discarded belt-pulley with a wrought-iron handle

A Lumbermen's Camp Which Can Be Moved from Place to Place on Rails

IN his account of the life of the rough and ready northern woodsman, Rex Beach often painted a realistic picture of his poorly-constructed and unsanitary home. As a rule, lumber camps enjoy but a temporary existence, and for this reason the houses are ramshackle affairs. The logging crew live in them a few weeks and then move on to another camp. The old camp is left at the mercy of the elements and no attempt is made to repair it, unless the loggers happen that way again.

In Everett, Washington, the temporary camp has been replaced by a permanent mobile camp consisting of railroad coaches. The coaches include kitchen, dining and bunk rooms for the men, blacksmith shop, engineers' and administrative offices, as well as equipment for heating, lighting and water supply systems. When the logging company wishes to move its camp to another part of the country, the cars are taken to that section by locomotives. Thus the camp cost is not only cheaper, but the men live amidst surroundings that are as near ideal in point of convenience as the local conditions permit.

One car supplies steam which heats all the cars, and another car contains a dynamo which provides current for one hundred and sixty-four incandescent lights. A third car is devoted to bathrooms and laundry.



The interior of the blacksmith shop in the portable logging camp. There are facilities for every kind of mechanical work that could possibly be needed



This logging camp consists of railroad coaches which have their own heating and lighting plant. The camp is portable

Pointers for the Inventors Working on the Submarine Problem

THE Naval Consulting Board has received literally thousands of suggestions and plans for destroying submarines and protecting merchant ships against torpedo attack. In addition, the Secretary of the Navy has also heard from inventors on the subject. The Naval Consulting Board has considered these plans and apparently has come to the conclusion that most if not all of them are worthless.

In Bulletin No. 1 which was published recently by the Secretary of the Consulting Board, No. 13 Park Row, New York city, and which bears the title "The Submarine and Kindred Problems," the difficulties that must be considered by the inventor are instructively summarized. That Bulletin ought to be in the hands of every man who thinks that he has solved the submarine problem. It

disposes of the electromagnetic devices suggested for detecting and destroying submarines; it dismisses the idea of "charging the sea with electricity"; considers the best and worst methods of protecting a ship against submarine attack, dwells upon the airplane as a device for discovering the submarine; comments on underwater sound-re-

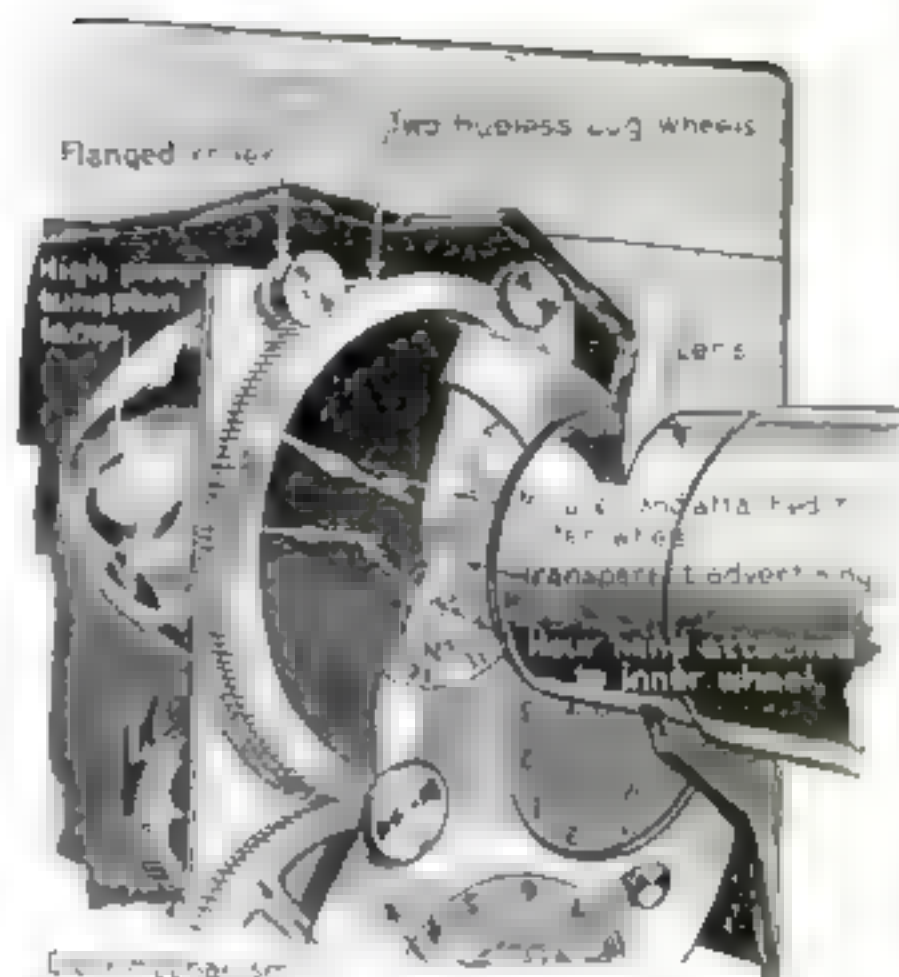
recording device, working on the microphone principle; brushes aside the use of nets or screens as a protection for cargo-carrying ships, and points out the merits and defects of present methods of destruction.

Making It Easy to See the "Movies"

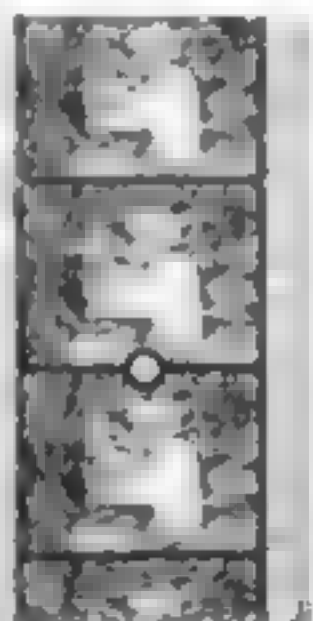
How tedious inserts can be avoided and how the clock can be watched

THANKS to the invention of Dr. J. W. Billings, any explanation that needs to be made in a motion-picture can appear at the same time that the action is going on.

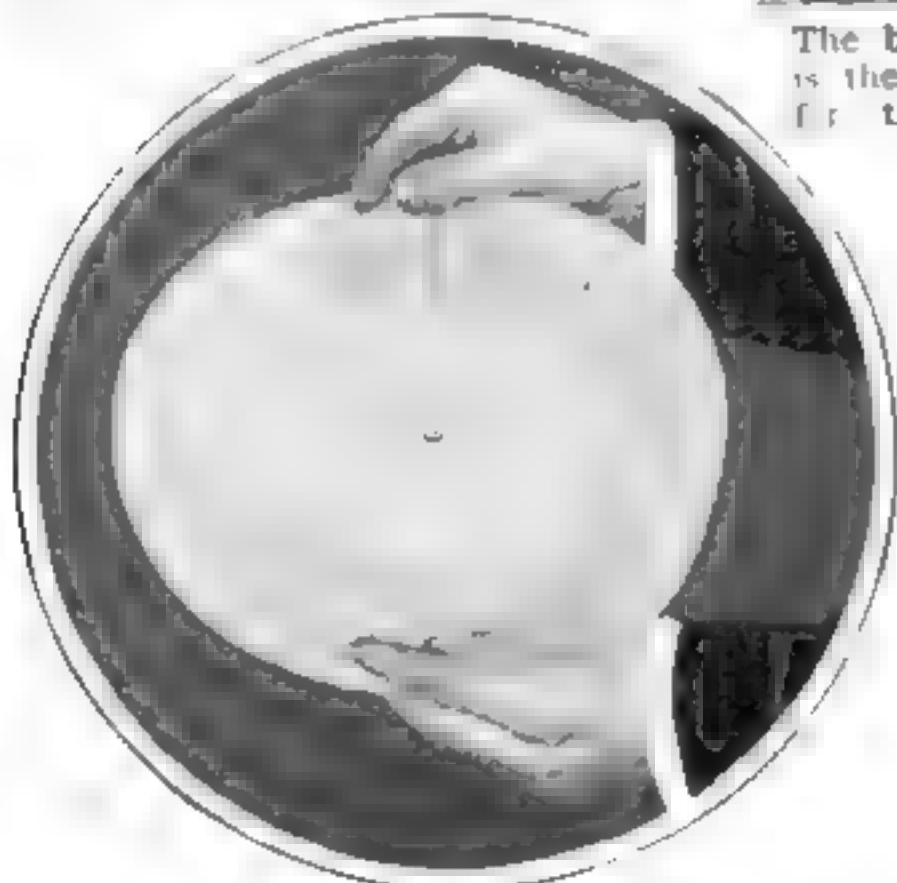
The inventor calls his contrivance for projecting captions a "descriptograph." In general appearance it looks not unlike an ordinary stereopticon. In the place where lantern slides ordinarily go, however, is a large disk having a number of radial openings. These radial openings contain the captions to be thrown on the screen and go through the field of the lenses on the lantern one after another, being moved along by an electromagnet, one radial opening at a time. On the film are little metal rivets or eyelets. When the film slides through the guiding and feed rollers, these metal rivets make an electrical contact with the rollers, completing a circuit through the electromagnet on the auxiliary lantern, or "descriptograph," down in the orchestra pit. This causes the descriptograph to throw a fresh caption on the screen. Just before the action on the main film is to change again, another rivet appears on the film, makes proper contact, and causes the electromagnet to



A machine for projecting both advertisements and a clock-face to tell the time of day



The brass eyelet is the space left for the caption



The disk which contains the captions printed for the screen in radial openings

pull a new caption into place. The whole plan is here illustrated.

Another device somewhat like the descriptograph is also being marketed. This contrivance, however, is for the purpose of projecting advertisements instead of captions. It has a special screen of its own, much smaller and to one side of the main screen as is shown in the illustration. In conjunction with its advertisement-showing features, this machine also projects the hands of a clock and a clock dial at the same time, this latter feature being an integral part of

the advertisement. Since people attending the show will inevitably look at the clock now and then to keep track of the time, the clock serves the special purpose of attracting attention to the advertisements.

As is shown in the illustration, the clock hands project inward from the rims of two large and hubless gearwheels through which light from the lenses of the lantern passes. In practically the same focal plane as that of the hands a wheel revolves in which are some half-dozen regularly spaced openings about the size of a quarter. Transparent celluloid disks cover these small openings, and on these the advertisements are painted or printed. By means of a suitable escapement device, this wheel shows six advertisements in rotation.

A Wooden Lighthouse Candlestick and How It Is Made.

IT is easy to make a wooden candlestick in the shape of a lighthouse. The one illustrated is about six inches high and about four inches in diameter. The lighthouse is white, with yellow and red ornamentation; the windows are painted.

The saucer in which the lighthouse stands can be used to receive burnt matches. It is nailed or glued to the lighthouse. Every lighthouse keeper has a daughter. Carve her out separately if you like and glue her into the saucer so as to have her leaving the door. Let her dress be yellow and her belt red.

The depth of the saucer is about two inches. It is painted red. These colors can be varied to suit the tones of the room or the owner's fancy.

A hole is cut in the top of the lighthouse to allow the candle to be placed inside.



The lighthouse candlestick makes a pleasing table decoration. The colors are varied to suit the fancy

tures to the exhaust pipe. The exhaust part of the valve opens when the piston has reached the limit of its downward travel on the power stroke. As the piston approaches the top of the cylinder in the usual manner, the valve is rotated counter clockwise by means of gears which are securely fastened to the crankshaft and valve respectively. They are in a ratio of two to one and are tied by means of a suitable belt or chain.

The by-pass in the valve remains open until the piston has reached the limit of its upward travel. When the piston starts back the aperture in the valve is rotated opposite the aperture in the cylinder head. The influx of gas is through the aperture in the cylinder head, through the rotary valve and its aperture, and through the

aperture in the cylinder head to the cylinder. The valve aperture remains open until the piston has reached the limit of its downward travel.

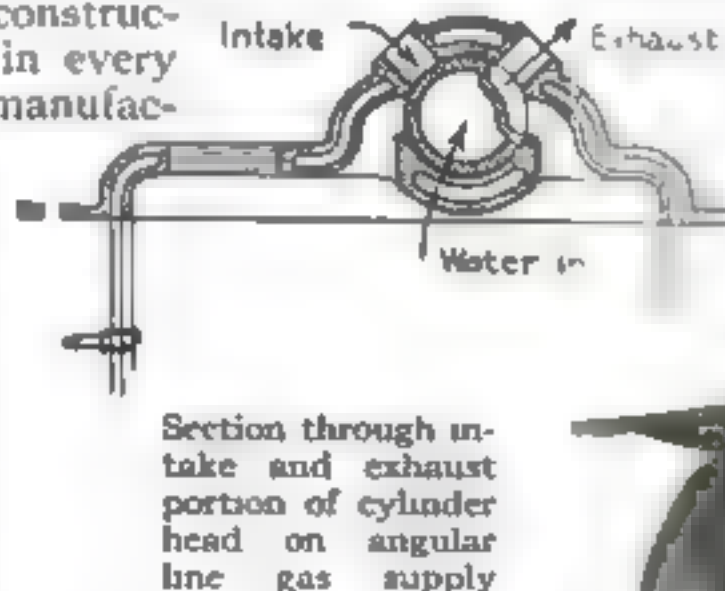
In this way the mechanism of the engine is so simplified that there is little chance of anything getting out of order and the life of the engine is considerably lengthened on account of the elimination of friction.

Getting Rid of the Poppet-Valves on a Gasoline Engine

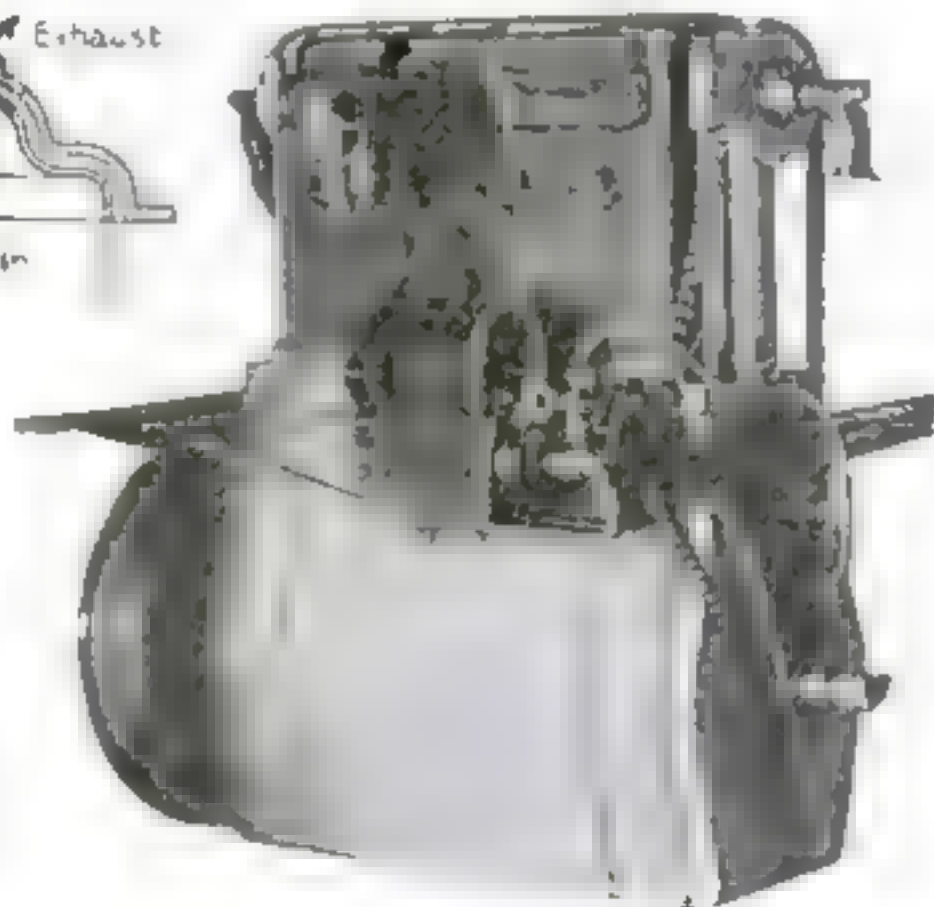
THE trend of the times in engine construction as well as in every other kind of manufacture is toward simplicity. Wherever one thing can be made to do the work of two or even more parts, nothing is left untried to facilitate the merger. A

western manufacturer has brought out a new gasoline engine in which the poppet-valve, camshaft and associated parts are eliminated and a common rotary valve substituted in their stead to perform the same functions.

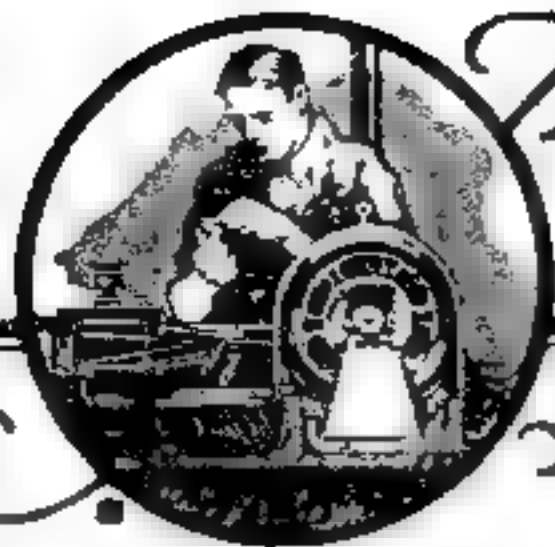
When the rotary valve is in a position opposite the apertures in the cylinder head, the burnt gases pass out through the aper-



Section through intake and exhaust portion of cylinder head on angular line gas supply



When the rotary valve is opposite the apertures in the cylinder head, the burnt gases pass out through the apertures to the exhaust pipe



The Amateur Electrician

And Wireless Operator

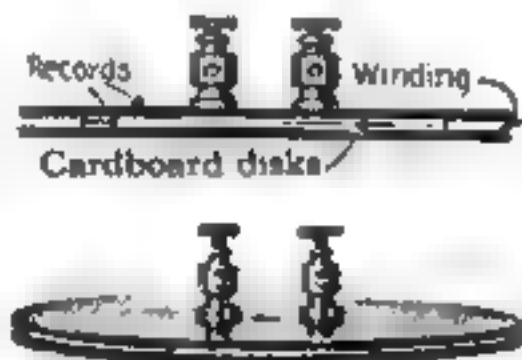
A Simple and Attractive Loading Coil

ORDINARY loading coils are often made in very compact form, as when wound between two hard rubber disks. Though very neat in appearance, such coils are hard to make without the aid of suitable machinery for turning out the rubber disk ends, which are expensive if bought ready made. If the method of construction described in this article is used, however, such coils can be easily made in a few minutes at a very low cost, and not only will they give the best of satisfaction, but they will present a very smart appearance.

The principal feature of this coil is embodied in the ends, which are small ten cent disk phonograph records. These can be bought for about five cents apiece second-hand at a record exchange shop, or in many cases at the 5 and 10 cent stores, wherever old records that do not sell well are reduced in price.

These composition disks are about $5\frac{1}{2}$ in. in diameter, and can be separated any desired distance by cardboard washers. The remaining space around the circumference of the cardboard and between the walls formed by the records is wound with fine wire, say about No. 28. The records can be turned so that the grooved sides face each other, thus leaving the smooth faces turned out and displaying the patent dates and numbers which are embossed on the bottom of the records.

The composition and cardboard disks are held together by binding posts passing



A coil of wire placed between record disks

through them near the center, or by several small copper rivets, arranged in a circle. These rivets may be used as contacts for a rotary switch, with which the inductance of the coil can be varied. After the holes for the binding posts and rivets have been made, and before the wire is wound on, all the disks to be used should be shellacked together in the proper positions, and dried under a flat weight of say 5 lbs.

The coil illustrated is a single step affair with only two binding posts. By making two separate windings, and fitting the coil with four binding posts, considerable advantage is obtained over the single step type. With the latter scheme the instrument can be used as a straight tuning coil with two variations of inductance, or the separate windings can be so coupled as to form an inductive tuner. It can be used to increase the wavelength range of primary and secondary of any loose coupled tuning coil.

Instruments made in this manner must be handled with reasonable care, both in the making and use, as the composition ends, while almost as strong as hard rubber of the same thickness would be, are too thin to be banged about indiscriminately. However in case of breakage the cost of renewal is slight — R. V. CLARK.

Using a Bicycle Pump for a Water Rheostat

A WATER rheostat can be quickly made from an old bicycle hand-pump. Remove the metal cap through which the rod passes, and substitute a plug of wood or cork.

Through the center of this plug a hole should be bored, its diameter being identical with that of the rod. Next remove the plunger disk and thoroughly clean the rod so it will be free from grease or rust. Wire leads should also be soldered to both casing and rod for electrical con-

nections. After closing the old air outlet of the casing, fill the pump chamber with water, and push the plunger through the hole in the plug. After the rheostat has been connected in an electrical circuit, a resistance of varying degrees may be obtained by merely manipulating the pump handle. This apparatus is very useful for experimental work, where it is necessary to have a very careful regulation of the current.—K. M. COGGESHALL.

Transmitting Wireless Messages Underground Without Aerial

WIRELESS messages can be transmitted without any aerial by using at each station two ground terminals not less than 200 ft. apart. One ground should extend but a few feet below the surface of the earth; the other should be sunk to a much greater depth, or better still, attached to a gas or water pipe. The receiving instruments are the same as when an aerial



A transmitting set with ground connections for sending messages without an aerial

is used, but at the transmitter a buzzer replaces the spark coil. An ordinary buzzer may be used with a thumb screw to tighten the armature so as to obtain a shrill hum rather than a buzz. A taut piano wire is even better than an armature.

A small, portable outfit can send and receive up to five miles by using a water-pipe ground, or up to three miles by using two ground rods at about 50 ft. apart. In the country, where there are no local electrical disturbances such as those caused by trolley cars, a tuner is unnecessary. For station work a tuner should be used, and an army field buzzer generating high frequency currents will considerably increase the sending radius.

Using an outfit very similar to the one described, Dr. H. Barringer Cox, of Santa Barbara, California, has succeeded in sending signals some forty miles. He

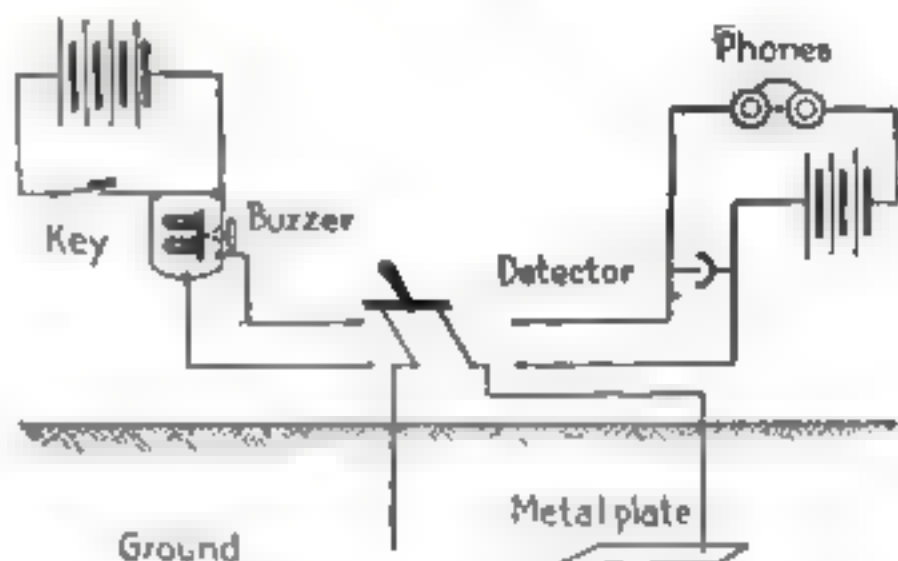
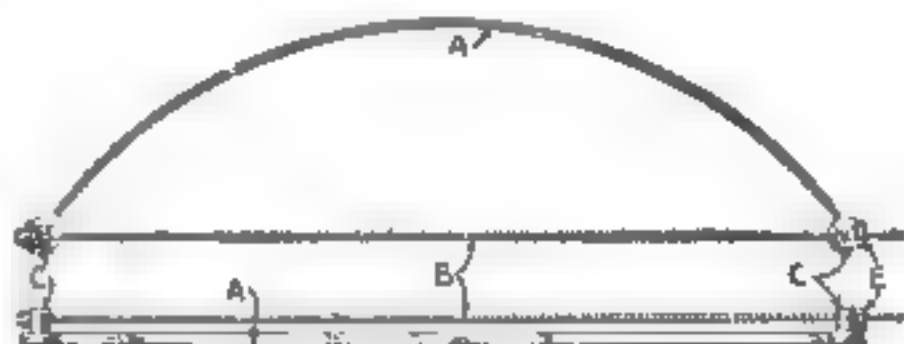


Diagram of connections with the instruments and the ground for the wireless set

declares that with a few slight changes he will be able to increase his sending radius to twice that distance. When perfected, this system may be valuable in military field work, as it does away with the necessity for laying a telegraph line or erecting an aerial.—J. E. HASTY.

A Flexible Spline Used for a Draughtsman Curve

IF one adjustable curve could be obtained draughtsmen would readily appreciate its value and prefer it to others. The illustration shows such an adjustable curve-making device that is simple and convenient. With this device it is possible to obtain a great variety of curves quickly and easily, that will fit to a fraction of a degree. Another advantage of this curve is that an arc of a given radius may be drawn any length desired.



A curve that is adjustable to a fraction of a degree to make an arc of a given radius

The curved piece *A* may be made of steel or suitable celluloid. The fine threaded rod *B* connects the ends of the bow at *C* and *C*. A thumbscrew *E* is used for adjusting the bow to obtain the required curve. The device may be made in any size.—NEY.

Sending Wireless Messages Under Fire

Mobile wireless stations on the western front

By Captain A. P. Corcoran, Late of British Army

YOU have heard much of the amazing inventions that have been developed during the great war—inventions that have displayed not merely human but diabolic ingenuity in their effectiveness in destroying human life. There are the British "tanks," and the German gas bombs which have accounted for many a good man. But not all are of such deadly character. Side by side with these weapons of destruction are many of more enduring worth, and high among these rank the motor wireless trucks, or lorries as they are called in England.

It is quite impossible to overestimate the importance of wireless in the great war, but the part that it plays differs with the character of the fighting. No army now but is equipped with wireless contrivances. The French use the de Forest system; the Russians and Italians, the Marconi; the Germans and Austrians, the Telefunken; and the British use two systems. One is the Leyland, the other is the Marconi—the standard $1\frac{1}{2}$ K.W. set—fitted in a Daimler motor truck. But though they all vary in details, in principle

they are the same. They are alike in all essentials.

A more compact contrivance than this traveling station it would be extremely difficult to find. The body of the truck is about 12 ft. by 6.

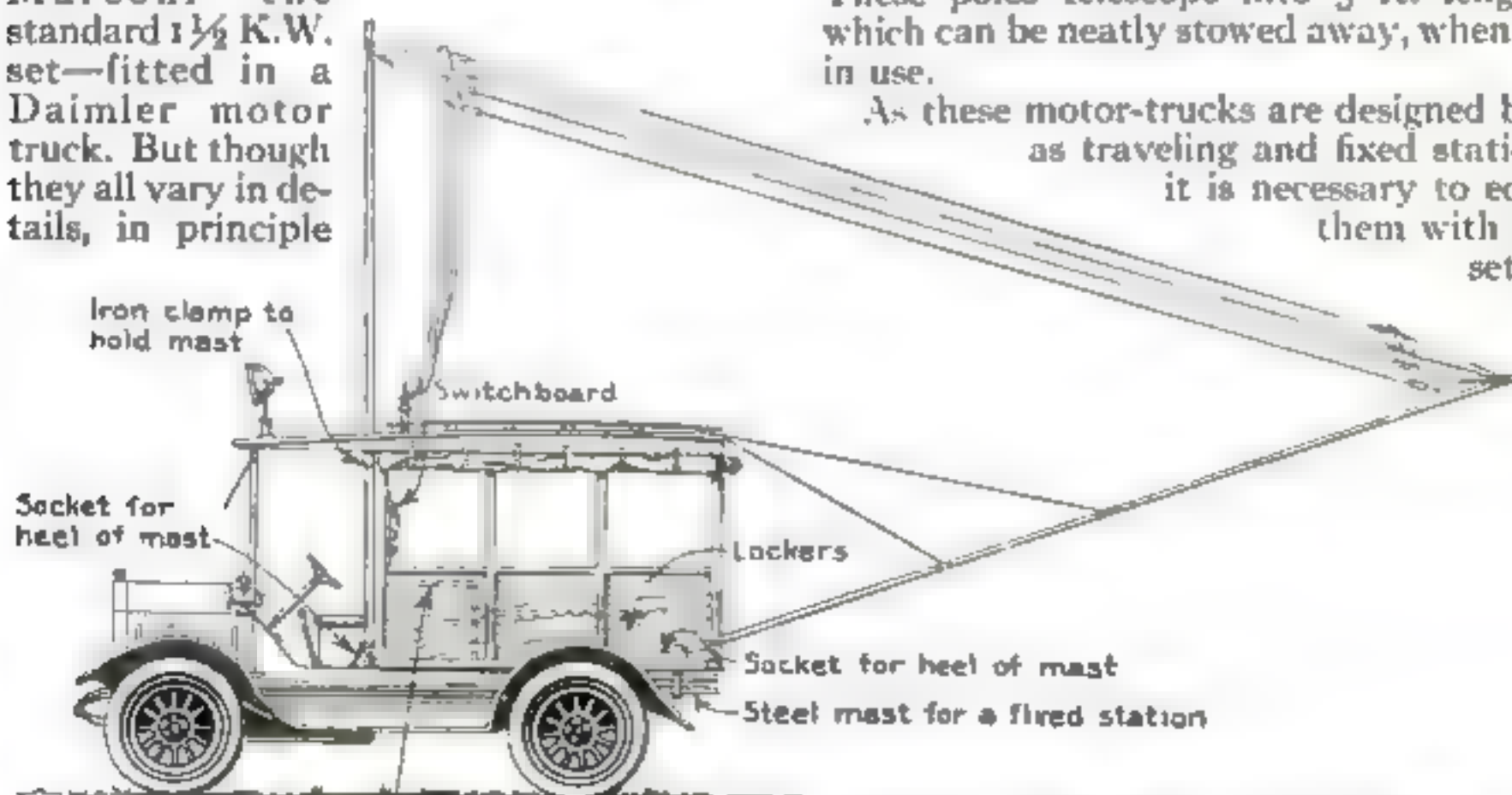
The entrance, of course, is at the rear. At the far end of the car is a bench 3 ft. high by 4 ft. deep, on which are placed the multiple tuner, the magnetic detector, the magnetic key, the operating key, telephone condenser and earth arrester. Underneath, the space is divided by a thick piece of board. On one side are placed the jigger, the aerial inductance, high tension condenser, sliding inductance, spark gap and transformer; while, on the other, are the rotary converter and a small dynamo, the starter and field regulator being fitted on the side of the vehicle.

Running along the truck, then on either side from door to bench, comes a locker 18 in. high by 18 in. deep. In this are stored the aerial, one set of aerial poles, insulators, spanners, etc. These poles telescope into 5 ft. lengths, which can be neatly stowed away, when not in use.

As these motor-trucks are designed both as traveling and fixed stations, it is necessary to equip them with two sets of



Captain A. P. Corcoran late in active service in the British Army in France



Multiple tuner, Detector, Transformer, Rotary, Condenser, Etc.

A motor-truck, designed for both traveling and fixed stations, which carries two sets of aerials

aerials. Hence the two sets of poles. The telescopic type is the one used for mobile purposes. For the other, the set consists of a 120-ft. steel mast, made up in 12 ft.

cog-wheel contrivance, operated by a handle, at the foot of the mast. They give a stretch roughly of about 100 ft. and carry four wires in parallel. Their power is derived from the truck engine which drives the dynamo, which in turn feeds the rotary converter.

On the retreat from Mons, during those terrible early weeks of the war, these lorries did wonderful work. Then everything was in a state of chaos, while General French's "Contemptible Little Army," as the Kaiser was pleased to term it, fighting every step of the way, was slowly retiring before the hordes of Prussians and Bavarians. All cables were cut by the terrific shelling, and fresh ones were laid only to be blown up the next minute. Then the trucks stood out, conspicuous by their efficiency. There were just three of these motor sets in use at the time, divided among the moving infantry. Close behind the line, they kept up a constant stream of communication between the fighters and General Headquarters.

And how those operators stuck to their posts! In the confu-



Laying the earth mats from the motor bus used for a wireless station

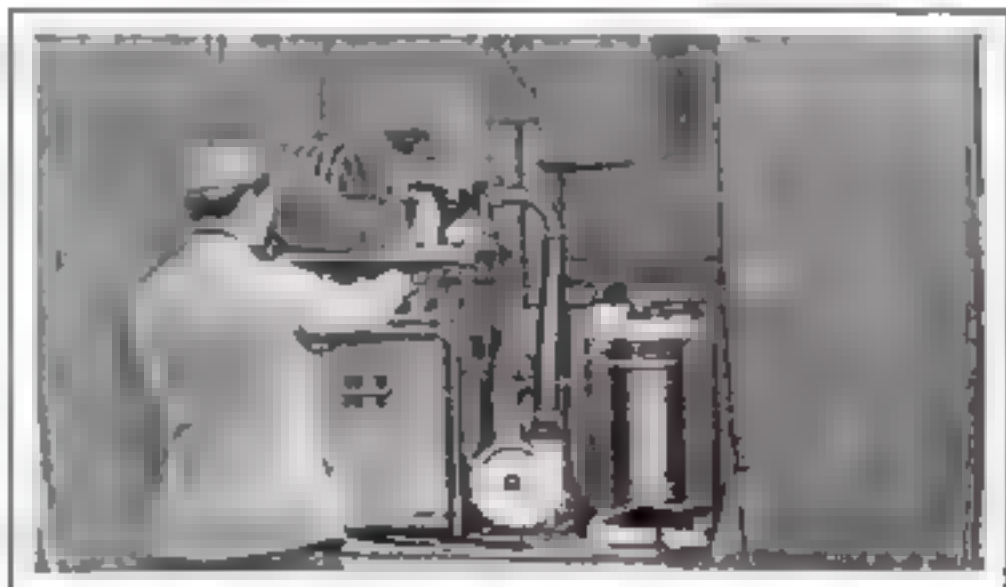
sections. It is carried underneath the truck

When the latter set is to be erected, the pieces are first laid on the ground, fitted together, and then raised to a perpendicular, in which position they are held by eight wire stays. The aerial, in this case, consists of eight wires, arranged umbrella-fashion, which, attached to the truck of the mast, touch the ground at a distance of 20 ft. from its foot.

The mobile type, on the other hand, has two sets of poles. The front pole is usually about 50 ft. high. When in position, it is fitted into a socket just alongside the driver, and is clamped to the top of the wagon, so as to be perfectly rigid. The back mast, which is also about 50 ft. long, is likewise fixed in a socket. Protruding at an angle of about 25 deg., it is supported in its place by four wire stays. Both these poles, as I have said, are telescopic. They are opened out by a



One man in a motor-truck receiving station stuck to his post for thirty-nine hours without sleep or rest



The interior of a French motor-truck with a soldier-operator transmitting a message in field operations

sion that prevailed, they were often personally forgotten, and it might be said that they forgot themselves. I know of one man who had the 'phones on from seven o'clock one morning until ten the following night—thirty-nine hours without sleep or rest. And I know of another



Motor trucks are especially fitted and equipped with apparatus as wireless stations

who stuck to his post with a splinter in his calf, causing him untold physical agony. A big shell had exploded at no great distance from his station and sent one of its pieces flying through the side of the truck.

But these accidental tests of physical endurance were not the only ones the men had to contend with. There were other more permanent discomforts, too. To each truck, of course, were detailed two operators, one for receiving and transmitting; the other for logging, filing and distributing. Usually there were orderlies also on hand, four or five as a rule following on bicycles. If a message was to be delivered to any commanding officer within the truck's sector, it was handed out to one of these. Just consider the position of those operators, penned up in that small space—very different from the accommodations on shipboard or their comparatively luxurious quarters on land. Usually both men wore 'phones to assist one another in receiving which, under the circumstances, was extremely difficult.

Quiet, as you know, is considered essential for the work of a wireless man, but quiet was the last thing these men could

obtain. To begin with, there was the incessant noise from the automobile engine; and there was the continual bumping of the truck over the uneven French pavement; and, last though not least, there was the occasional roar from nearby big guns.

Tire Deterioration Caused by Improper Storage

WHEN exposed to the light and sun, especially to the hot summer sun, a rubber tire is likely to dry out, harden and become impaired in efficiency in consequence. The manufacturer wraps his tires in paper to protect them from the light when they are to be kept in stock at the factory. This also keeps them in shape. It is a good plan for the purchaser to leave the paper wrapper on extra tires, or, if the paper has been removed, to use the tire for a short time until the rubber becomes soiled before storing it away. The pores will thus be filled by the thin coating of dust, which will have a preservative effect.

Tires should not be kept in a warm place for any great length of time, as light and heat will cause the sulphur to come out on the surface and make the rubber minutely porous. After gum checking or oxidation takes place, the nerve or fiber of the rubber is destroyed, with consequent bad effect upon the flexibility and durability. A dark, dry room at a temperature of from 40 deg. to 50 deg. is most favorable for retarding chemical action in the rubber tread, side walls and the adhesive friction stock between the layers of fabric.

When the car is laid up for the winter, or for other reasons is not used for several weeks, the stale air should be removed from the tires. Partially inflate with fresh air—enough to round out the tires and cover them with muslin or other material to protect them from the light. The car should be supported by blocks or jacks so that there will not be any weight on the tires.

Paint for Use on Exterior Surfaces Should Be Left to Ripen

PAINT for exterior use should be allowed to stand after mixing for a day or two to ripen. It has been found that paint mixed and applied at once will not begin to give as good results as that given sufficient time to ripen after mixing.

A New Type of Acid-Proof Brush for Soldering Flux

THE use of non-corroding paste in soldering has, in many cases, done away with the disagreeable and dangerous acid brush. There are still a few jobs, however, which require an acid flux for soldering. To those who have occasion to use soldering acid of any kind, the non-corrosive acid brushes shown in the illustration should prove serviceable.

Both of the brushes shown employ a small piece of rubber sponge for the brush proper, while the handles are made as illustrated, one from an old rubber pen barrel and the other from a section of tubular porcelain insulator.

The piece of sponge mentioned is forced into one end of the rubber or porcelain handle, as shown.—R. U. CLARK.



A discarded fountain pen case and a section of tubular porcelain insulator for brush handles

good insulation from the motor shaft with extreme lightness.

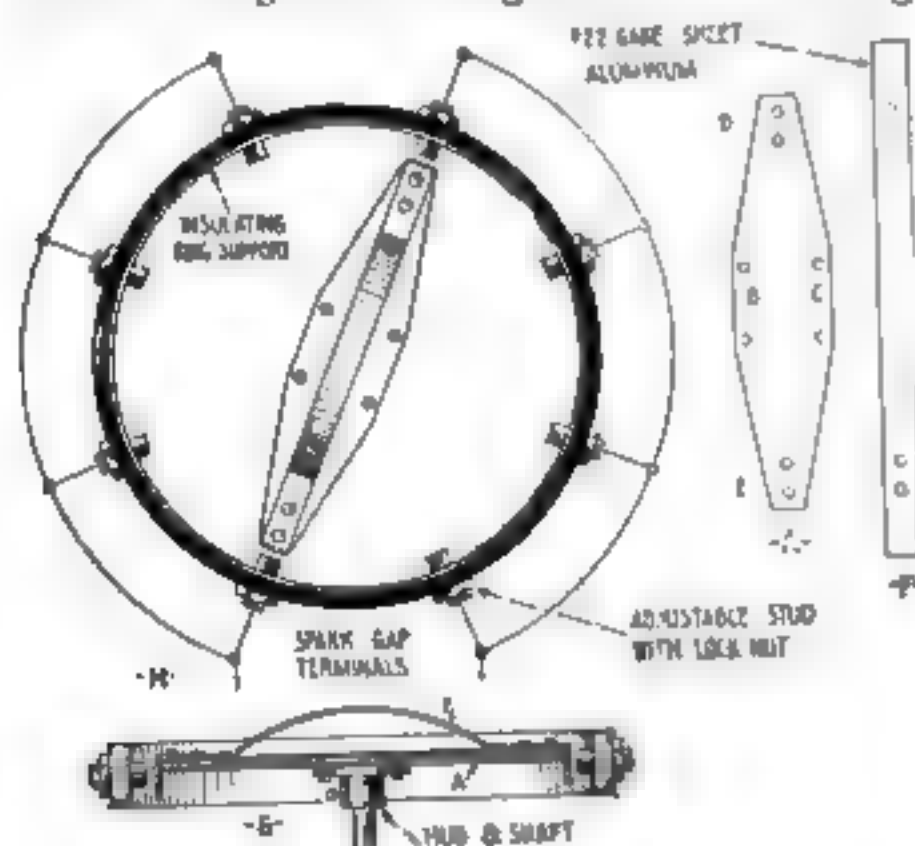
To make an arm embodying these features, proceed as follows: From a piece of fiber or bakelite of suitable length and $\frac{1}{8}$ in. thick, cut a strip to the shape shown at A. The widest part should equal the diameter of the shaft-bushing, so as to fit flush. The dimensions will, of course, vary with the size of your ring; but in any event the length of this piece should be $\frac{1}{4}$ in. less than the distance between faces of opposite studs. Holes B and C are for fastening to the hub on the motor-shaft. Holes D and E, tap 2-56, are for screwing on the aluminum strip shown at F. This piece is $1\frac{3}{4}$ in. longer than the fiber.

At a point $\frac{3}{8}$ in. from each end bend the aluminum at right angles. This forms the sparking surface. Now, about $\frac{1}{2}$ in. in from the bend on both ends, curve the strip as at G. Screw it down, as shown, to the fiber arm. After screwing on the hub, mount it as shown at H.

The proper adjustment of distance between electrodes is accomplished by changing the stationary studs. This type of rotating arm is not only extremely light, allowing a quick start, but also has the advantage of cooling rapidly, owing to the exposed surface curving away from the fiber strip. This curve should be at least 1 in. from the center for good insulation.

Construction of a Rotating Arm for a Rotary Gap

TO those amateurs employing a rotary spark-gap of the type having the studs arranged in a ring about a revolving



A light rotating arm constructed so that it is well insulated from the motor shaft

arm, the construction of this arm often presents difficulty; for it must combine

Using Resistance in Field Wiring on an Automobile Dynamo

MANY times the car owner is not entirely familiar with the lighting system and does the wrong thing when trouble occurs. Cars are equipped with a generator that will carry about six 12 c. p., 8-volt, tungsten filament bulbs. Each bulb takes about $1\frac{1}{2}$ amperes. If it is desired to use only a part of the bulbs at a time it is necessary to connect in the line a resistance equal to that used by the bulbs cut out of the circuit. This resistance should be put in the shunt field wiring to prevent the voltage from running too high.

Wireless Work in Wartime. III.

By John L. Hogan, Jr.

THE two articles of this series which have already been published, in the August and September issues, outlined the simplest ways to learn the Morse Code used in radio telegraphy and explained a buzzer-telegraph line which could be used for code practice. The cooperation of two students in the manner indicated makes it possible for both to advance far more quickly than could either one working alone. By placing themselves at the opposite ends of an electrical communication system (the buzzer-telegraph line) and by relying upon it for the interchange of messages and for correction of errors of transmission, both operators learn to depend upon their own efforts to signal correctly. It becomes evident at once that clear, uniform formation of the Morse dots and dashes is essential to real telegraphing, since poor sending at once brings its natural consequence of incorrect receiving. The greatest temptation of the novice telegrapher, viz., to send too fast, is quickly shown to be productive of nothing but trouble; to send so fast that the words run together, or so fast that incorrect Morse characters are formed, or so fast that the receiving operator cannot put the words down easily and completely, is to show one of the clearest signs of incompetence. The experienced operator suits the speed of his sending to the particular conditions, and never transmits the words so fast that the receiving operator cannot "copy" all of them. To adapt one's gait to the man at the other end of the line, be it wire or wireless, is not only common courtesy but has been found by long experience to result in the accurate transmission of the greatest num-

ber of words in any given length of time.

Dangers of Student Practice

Although the buzzer practice line has the advantages indicated above, there is a danger in having no sending to listen to except that of a companion student. Starting from the ground, with no telegraphic experience, one is likely to make some mistakes even though the greatest care is used. It is most difficult to form the complex characters like "Q" (dash-dash-dot-dash) and "Y" (dash-dot-dash-dash) correctly, and a beginner is always likely to interject an extra dot-space or two. Consequently "Q" is made to sound like "M A" (dash-dash, space, dot-dash), and

"Y" seems very much like "N M." This defect may be noticed after the word "YOU" is written out as "NMOU" several times, but the way the student usually corrects the fault is by increasing the space between "Y" and the next letters. This

has the effect of setting off the "NM" character, but is not a real cure, since the dash-dot-dash-dash of the letter "Y" has not been smoothed out into perfect form.

There are a large number of errors like these which creep into the sending of students, and, occasionally, even into that of experienced operators. They are always dangerous, however, and often lead to serious misunderstandings. Listen to your own sending, and to that of your partner, and try to make sure that each dot, dash and space is formed and timed correctly. You can weed out these troubles yourself by giving the Morse characters keen enough study; but the best plan is to have some experienced operator listen to your transmission and criticize it for you. After you

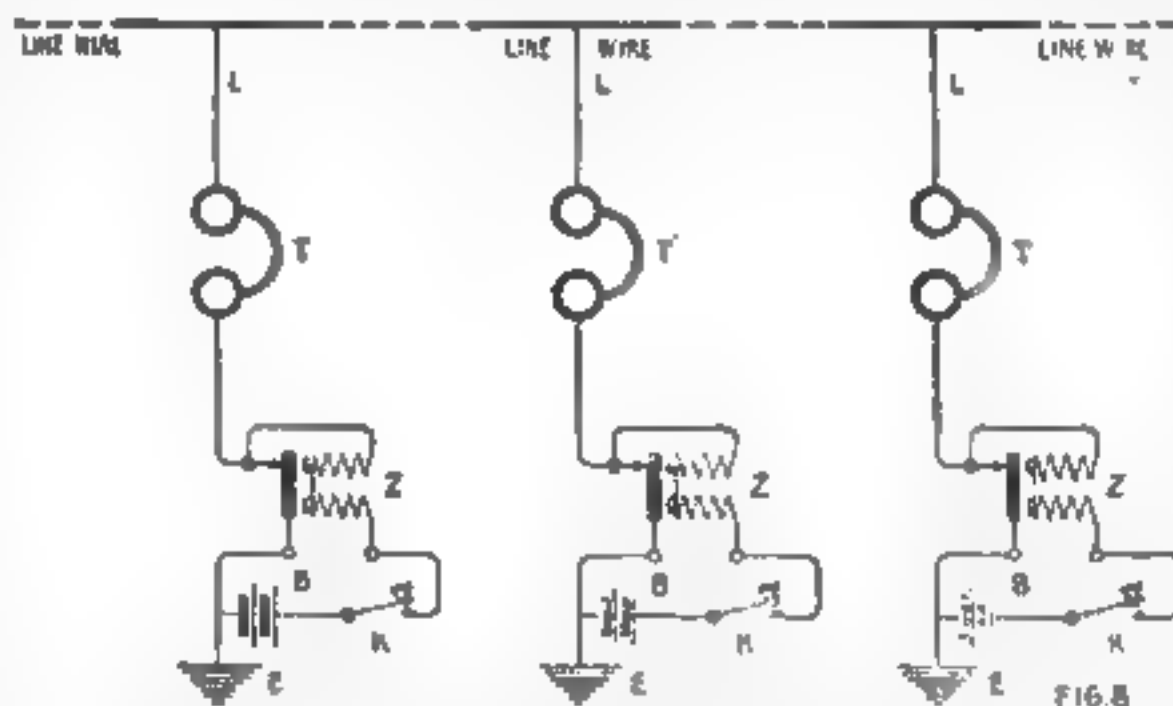
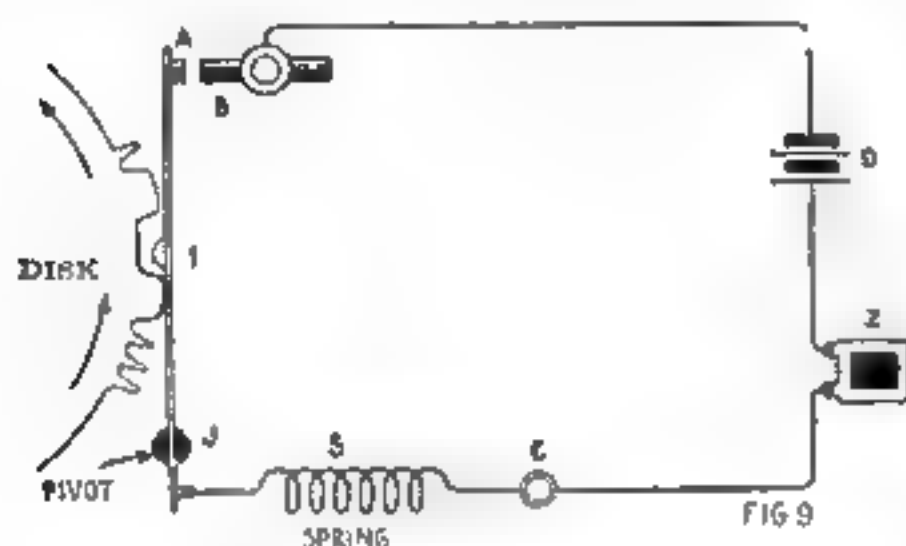


Diagram showing how three stations may be connected with the same line wire and other units may be added as desired

have learned all the letters, and are able to call them to mind easily, try to get some trained wireless operator to call on you and send over your buzzer line. If you will send the alphabet through from A to Z several times, and follow it with the



A rotating disk with notches in its circumference to make the dots, dashes and spaces

classical sentence, "The quick brown fox jumps over the lazy dog" (which contains every letter of the alphabet), he will soon be able to judge wherein your sending is in need of improvement, and to correct you. Be sure to pay strict attention to his suggestions, for they will probably be valuable to you.

After your sending has been passed on by a seasoned operator, try to have him send for you a little while. Ask him to send so slowly that you can get every letter, and pay close attention to the smoothness with which he forms the dot and dash combinations. If you can, have him take the key at the station at one end of your line, and go to the other end yourself. By exchanging a few messages with him, and listening sharply to his style of Morse sending, as well as by having him note the imperfections in your sending, you can do a great deal toward perfecting yourself in the art of telegraphing.

Three-Station Lines

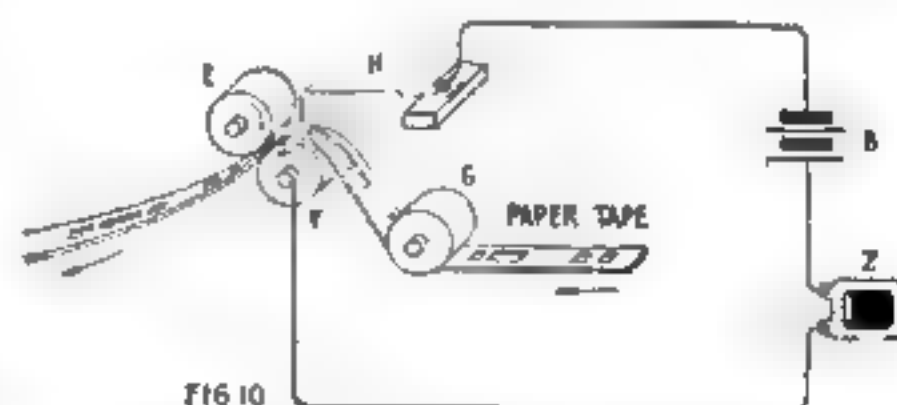
Occasionally it is possible to run the buzzer telegraph line by the home of a wireless operator, and to install a third station in his house. If he is willing to help you out, he will send from a newspaper for half an hour or so each evening, and then let you send to him for ten or fifteen minutes. This sort of practice will be exceedingly valuable, if it can be arranged. Sometimes half a dozen students wish to get on the same buzzer-telegraph wire and to practice together. Fig. 8 shows how

three stations may be connected with the same line wire, and identical station-units may be added almost without limit. Pressing the key *K* at any one of them will operate its buzzer *Z*, by reason of closing the circuit from the battery *B* through the buzzer magnet windings, and the signal-tone of the buzzer will be reproduced in the telephones *T* at all of the stations. It is only necessary to keep the insulation of the line wire *L L L* fairly good, so as to prevent leakage, and to make a good connection to earth through a scraped water, gas or steam pipe at each of the points marked *E* in the diagram Fig. 8. The higher the resistance of the telephones, up to several thousand ohms, and the more powerful the buzzers and batteries, the better the line will work when a comparatively large number of stations are added to it. If the signals in any of the telephones are found to be too loud, their terminals may be shunted by a resistance of fifty or a hundred ohms or thereabouts (the best amount being found by trial), as shown in Fig. 5 (last month's article).

It is not always easy or even possible to get a wireless operator to visit your home and try out your buzzer line; if you find this difficult, it is a good plan to call at some local telegraph office and to try to pick up a few pointers from the operators there. Although the line telegraphers in the United States use the American Morse code, which differs as to some of its characters from the International Morse used in wireless, the two systems have much in common and a few words of criticism from a skilled line operator will often be of inestimable value to the student.

Copying Perfect Signals

Such a plan, however, does not give the



Another type of automatic sender in which a tape is used having holes in it for the letters

student any opportunity to listen to and copy perfectly formed Morse characters at gradually increasing speeds. The two-

student plan of learning will of course develop both the speed and reliability needed, a little at a time, but for the best results there should be some way to check and eliminate possible errors in sending which may pass by both students quite unobserved. The best way to take care of this difficulty is by the cooperation of a skilled operator, as explained above. If no such help can be secured, the next best plan is to use an automatic sender of some sort. Such an auto-transmitter, driven by clock-work or by a small electric motor, can be used in self-instruction or by a group of students. Several types are available, but the two most employed use metal disks or paper tapes already prepared and carrying various combinations of words and letters in common usage.

The Disk Sender

The operation of the metal disk type is indicated in Fig. 9, where the disk itself is shown rotating in the direction of the arrow and having notches cut around its circumference to correspond with dots, dashes and spaces. As the disk revolves, the point on the spring arm *P* moves back and forth along the irregular teeth, and the contacts *A* and *B* are brought together and separated to form dots and dashes. When the contacts are pressed together the battery circuit from the dry cells *D* through the buzzer *Z* is closed by way of the pivot *J*, spring *S* and binding post *C*, and the buzzer sounds. A short tooth on the disk produces a dot signal, and a long tooth a dash. Thus the notches shown in Fig. 9 would produce dot-dash, space, dash-dot-dot-dot, or the letters "A" and "B" separated by a space.

The metal signal-disks are made up in great variety, and are interchangeable so as to form complete messages. For beginning of practice there are disks giving the letters

of the alphabet singly and in regular order, and also in mixed order. This last named arrangement is especially desirable for practice, since it is almost impossible to anticipate the letters about to be sent, and the student is forced to listen closely and think quickly in writing the letters as they

occur in what amounts to a long cipher word. Several forms of the disk

sender are made, under the trade name of "Omni-graph," in which the disks are rotated either by hand or by clockwork. The automatically driven type is by far the best for serious work, since its speed may easily be adjusted to almost any rate which occurs in telegraphy, and, once started, the instrument may be put completely out of mind and full attention given to

writing out the letters and words produced by the buzzer.

The Paper Tape Transmitter

Another sort of automatic sender is shown in Fig. 10, in which a cut paper tape passes between a spring contact and a metal roller. The sketch shows how the "slip" is threaded over a guide roller *G* and between the two driving rollers *E* and *F* which turn in the directions indicated by the arrows. The spring contact *H* bears down on the paper, and, when a hole in the tape comes under it, makes contact with the metal roller *F*. This closes the battery circuit from the cells *B* through the buzzer *Z*, and the buzzer reproduces the dots and dashes cut in the paper strip. On the left is

shown the letter "R" (dot-dash-dot) and on the right the letters "A" (dot-dash) and "I" (dot-dot). An automatic transmitter of this general sort, in which the tapes are cut to give various word and letter combinations, is sold under the name of the "Audible Alphabet." The instrument is driven

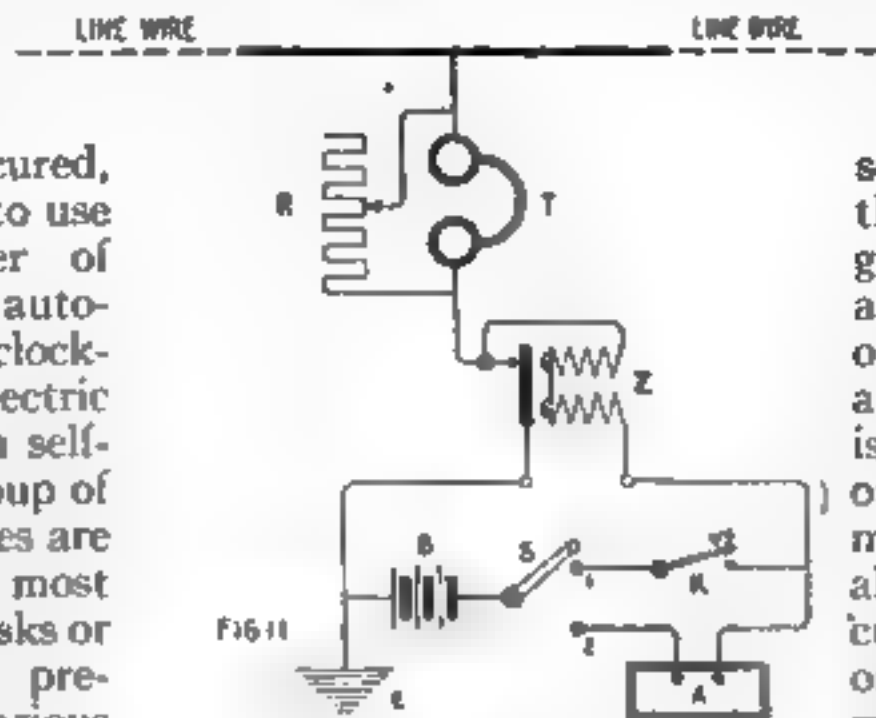


Diagram of connections for an automatic sender in a line

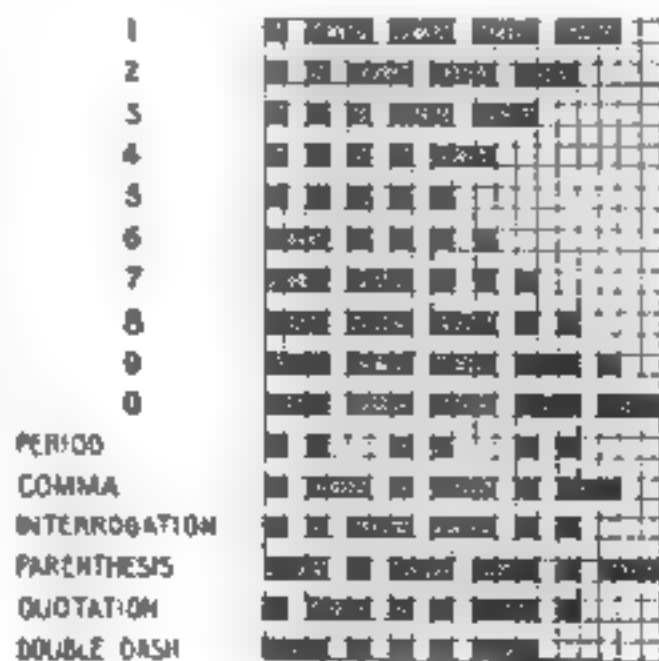


FIG 12

The numerals and the most used punctuation marks in telegraphy

by turning a small crank by hand, but it is not difficult to gear a small electric motor to operate it and thus to afford true automatic operation.

Any sort of automatic transmitter can be made very helpful in learning the code. The apparatus is not very expensive, and if five or six students combine to purchase one together the cost to each individual becomes extremely low when compared with the benefits secured from having a tireless sender of perfect Continental Morse signals which will give practice as long as it is wanted. Fig. 11 shows how to connect the automatic sender at one of the stations of a multiple-station buzzer-telegraph line. The balance of the stations are wired in accordance with Fig. 8. The automatic sending station of Fig. 11 may be chosen to be somewhere near the middle of the telegraph line, so as to give about equal strength signals at both ends; the line wire extending to the other instruments is indicated by the broken line at the top of the figure. The telephones *T* are shown shunted by the signal-intensity regulating resistance *R*, and connected between the line wire and the vibrator post contact of the buzzer *Z*. The two outer terminals of the buzzer are connected in series with the battery *B*, a single-pole double-throw switch *S*, and either the hand-sending key *K* or the automatic transmitter *A*. The armature post of the buzzer is connected with ground at *E*. When the switch *S* is in position 1 the hand key is connected, and signals may be transmitted in the usual way. When the switch arm is in position 2, the key is cut out and the automatic transmitter placed in circuit. The signals which it sends out are transmitted both up and down the line, and may be copied simultaneously by all the students at their respective home stations.

Morse Practice on the Buzzer Line

By arranging a definite time schedule for running the automatic sender, it is possible to work out a scheme of daily Morse practice at gradually increased speeds, until finally all the learners are able to write down messages at a speed of from twenty to twenty-five five-letter words per minute. To make the practice comprehensive it is necessary to arrange for periods of sending practice for each of the stations, in which one student sends messages or press notes from the newspapers and all the others copy his signals. The messages as copied by each one should be carefully

compared with the original as it was sent out; errors in receiving can be located by reason of their appearing on only one of the copies, while errors in transmitting should show up in all of the copies. Practice of this sort, varied by the exchange of messages between various pairs of stations on the line, will give the most valuable training which it is possible to secure outside of actual radio telegraphy.

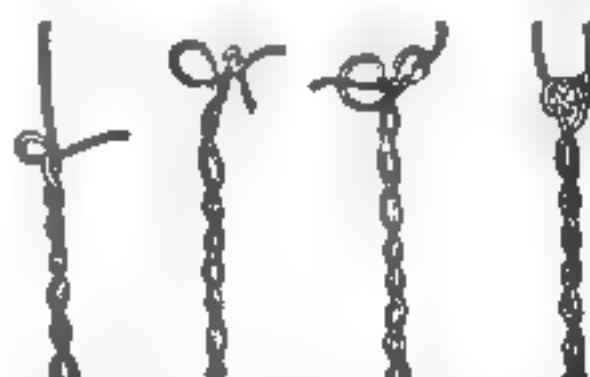
In the first article the Morse symbols corresponding to the twenty-six letters of the English alphabet were given. Fig. 12 shows the numerals and the more usual punctuation marks. These should all be memorized and used in the message practice. Entire familiarity with the code as thus completed will come with the daily sending of dispatches, and a few months of this work should make any apt student a fairly skilful telegrapher.

In the next article the formal methods of sending messages with full preambles, according to the International Radiotelegraph Convention, will be explained and illustrated, and the problems of reading messages and signals through interference from other radio stations and from "static" or atmospheric electrical disturbances will be discussed.

(To be continued)

The Underwriter's Knot for Flexible Cords

FLEXIBLE cords used to suspend a lamp should be arranged so that there



A knot tied in line in such a way as to take the strain from a fixture

is no stress or strain coming on the binding posts or connecting screws. To provide a suitable holding means, knot should

be tied in the cord to make them take all the weight of the socket and fixture from the ends of the wire. The successive steps in tying the knot are shown in the illustration.

While these knots may appear to be of no use they are absolutely necessary, not only to relieve the strain, but to fulfill the requirements of the underwriters' code for safety in insurance.

Making a Practical Vacuum Cleaner

I. -Details in the construction of the universal motor

By L. E. Swindell

THE machine described is not a difficult piece of apparatus to construct, and it will do the work equally as well as a standard make. However, building it yourself will not reduce the cost to any appreciable degree. The only thing gained will be the satisfaction of saying "I made it myself." The essential parts are a high speed electric motor to drive the centrifugal fan, and a suitable case with a shoe or nozzle to collect the dust from the floor and discharge it into a cloth bag which retains the dust and releases the air.

The following materials are necessary in the construction of the vacuum cleaner.

MATERIALS FOR THE MOTOR

- 90 pieces transformer iron 0.015 in. thick, $3\frac{1}{2}$ in. sq.
- 90 pieces transformer iron 0.015 in. thick, 2 in. sq.
- 1 shaft, cold rolled steel $\frac{3}{8}$ in. diameter and $7\frac{1}{4}$ in. long
- 2 bolts $\frac{1}{4}$ in. diameter and 4 in. long, threaded $1\frac{1}{4}$ in. on each end
- 2 hardwood blocks $3\frac{1}{2}$ by $3\frac{1}{2}$ by 1 in.
- 1 piece iron $\frac{5}{8}$ by 7 by $\frac{1}{8}$ in.
- 2 iron washers $1\frac{1}{2}$ in. diameter, $\frac{3}{8}$ -in. hole
- 2 8-32 brass screws 1 in. long
- 2 pieces brass tubing $\frac{1}{4}$ by $\frac{1}{4}$ by $\frac{3}{4}$ in. (inside measure)
- 4 fiber washers $\frac{5}{8}$ in. square, $\frac{1}{8}$ -in. hole, $1/16$ in. thick
- 1 commutator, 22 segments
- $\frac{1}{2}$ lb. No. 26 gage enameled magnet wire
- $\frac{1}{4}$ lb. No. 29 gage enameled magnet wire.

MATERIALS FOR THE SHOE

- Enough sheet iron 1-16 in. thick
- 15 soft iron rivets $\frac{1}{8}$ by $\frac{3}{8}$ in.
- 6 8-32 brass screws $\frac{1}{4}$ in. long
- 1 cylinder of brass $1\frac{1}{2}$ in. long by $\frac{5}{8}$ in. diameter $\frac{1}{4}$ -in. hole
- 1 piece of fiber 1 in. thick 2 by 2 in. square
- 2 pieces iron $\frac{5}{8}$ by $\frac{1}{8}$ by 14 in.
- 1 hardwood handle $3\frac{1}{2}$ ft. long, $1\frac{1}{8}$ in. diameter

If you can secure a fan motor of suitable size you will save yourself considerable time and labor. For the benefit of those who cannot obtain a motor, or who wish to build their own, the necessary directions will be given for the construction. If a motor cannot be procured some machine work on a lathe and drill-press must be done.

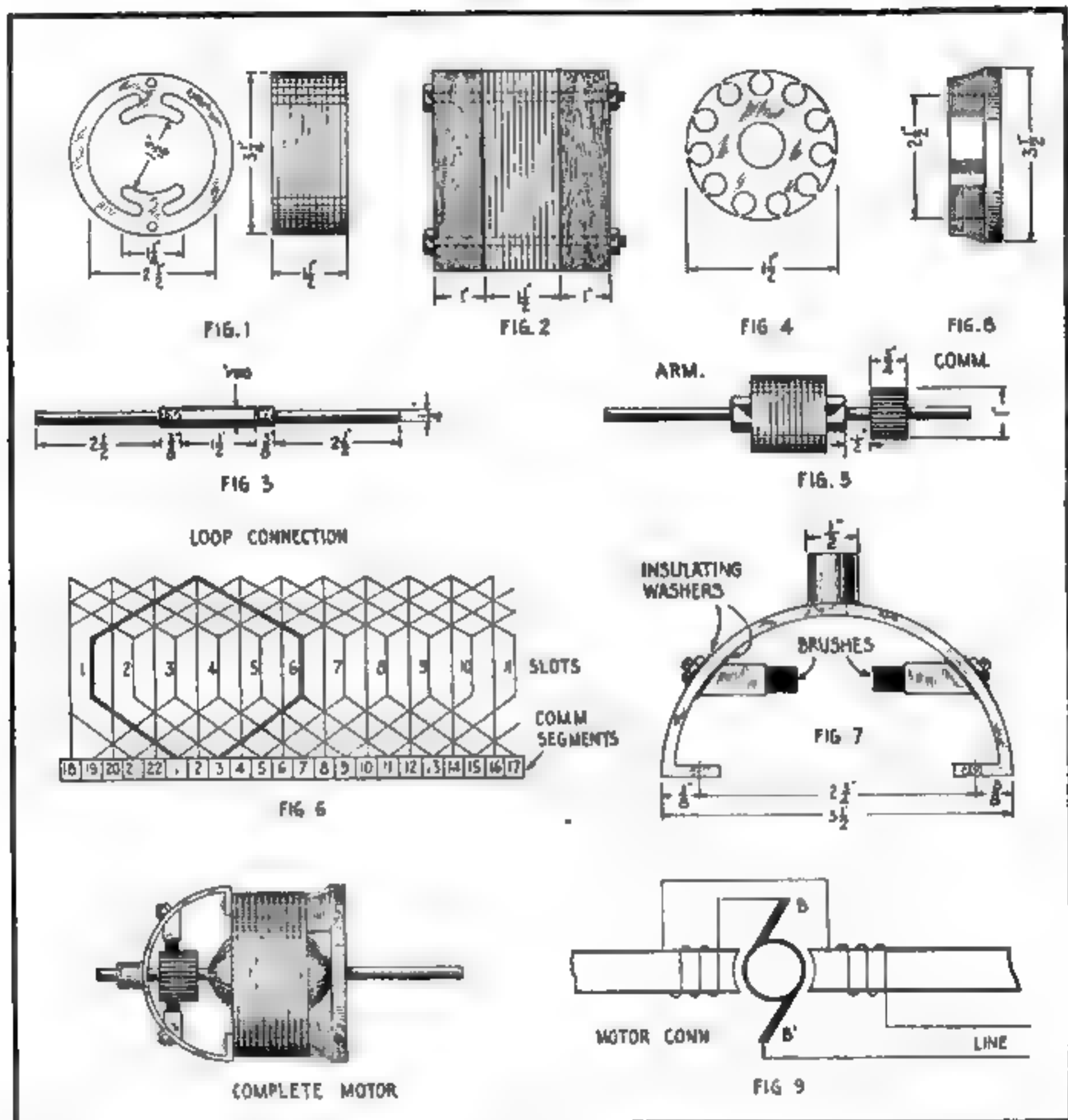
The Motor

The motor is of the alternating current series type, wound for use on 110-volt circuits. It may also be used on direct current. The field for use on direct current could be of solid iron, but for alternating current it must be laminated because of eddy-currents and excessive heating.

The dimensions of the field magnet are given in Fig. 1. A stack of transformer iron $3\frac{1}{2}$ in. square and $1\frac{1}{2}$ in. thick should be clamped between two hardwood blocks by means of the two 4-in. bolts as shown in Fig. 2. Now proceed to turn the mass of iron and wooden blocks to a diameter of $3\frac{1}{4}$ in. Use a high speed and a very sharp tool, cutting toward the lathe chuck. The center should be turned out to a diameter of $1\frac{9}{16}$ in. The wooden blocks should now be removed and the pole pieces machined. This is the most difficult for the amateur to do. If the directions are followed and a little patience used, a neat job will result. If a row of holes are drilled between the pole pieces just inside the $2\frac{1}{2}$ in. diameter, the remaining material can be easily removed with a sharp cold chisel and finished with a round file. The laminae can now be taken apart and each varnished with black insulating varnish. When dry, reassemble the laminae and proceed to wind the field.

Each pole is surrounded by a coil of 200 turns of No. 26-gage enameled magnet wire thoroughly insulated from the iron by empire cloth. The wire should be wound on by hand so that it will occupy as little space as possible. The field poles should be thoroughly insulated by means of strips of empire cloth wound tightly around them and then varnished. The leads should be brought out and the coils connected in series; i.e., the end of one coil should be connected with the beginning of the other. The two free ends should be brought out and protected from injury, and the finished field set aside while the armature is built.

The armature is of the usual drum type, with eleven drilled slots to receive the windings. The shaft is of cold rolled steel,



Entire details of all the parts necessary in the construction of a universal motor that is especially adapted to drive a fan on the ordinary vacuum cleaner used for household purposes

7/16 in. in diameter, rough, to be turned as shown in Fig. 3. The threads may be cut in the lathe at the same time that the shaft is being turned. Now bore a 3/8-in. hole through the center of the stack of 90 2 by 2-in. iron and then varnish the plates. When dry slip them on the shaft and clamp them between the two iron washers. Do not tighten the nuts too much or stripped threads will result. Now proceed to turn the armature to a diameter of 1 1/2 in. Be very careful not to feed the lathe tool too fast or it will cause the

plates to turn on the shaft. Now lay out the eleven slots as shown in Fig. 4. The drilling should be done in a drill-press and the armature set in a jig so that the shaft will be parallel to the drill. Great care should be used to get the slots absolutely parallel to the shaft and accurately spaced. With a hack saw cut through the 1/16 in. of metal on the diameter of the laminae and smooth up with a small file.

The shaft can now be finished to 1/4 in. in diameter. This should not be done earlier because it would twist out of shape

while the laminae are being turned. The armature is now ready to receive its winding. Referring to Fig. 6, the method of wiring can be easily understood. There are two coils per slot, each having a span of six slots. The winding consists of twenty-two coils, each of which is composed of 20 ft. of No. 29-gage enameled wire. Now measure eleven 40-ft. lengths of wire and in the middle of each twist a loop about 1 in. long. Before beginning to wind the armature the slots must be lined with empire cloth. Cut from the cloth eleven strips $1\frac{5}{8}$ in. long and 1 in. wide and line each slot, using a little glue to hold them in place.

Beginning with slot No. 1, skip to slot No. 6 and wind until you come to the loop, which should be brought out on the side of the commutator. The next coil is wound in the same manner in slots No. 2 and No. 7, etc. Now to the end of the first coil (not the loop) twist the beginning of the second coil. It is well to tie a knot in the end of each coil for identification when the commutator connections are made. When the winding is complete it should be tested for grounds and breaks, etc. This may be easily accomplished by means of an incandescent lamp in series and the lighting circuit. If the coils pass the test, strips of fiber $1/16$ in. thick, $5/32$ in. wide, and $1\frac{1}{2}$ in. long should be inserted in the slots above the wire to prevent the wire from being thrown out by centrifugal force. Now give the armature two coats of insulating varnish and set aside to dry.

We will now need a commutator. The writer has found by experience that this had best be purchased. It may be obtained from an electrical repair or supply shop for a small sum. It should have 22 segments and be of the dimensions given in Fig. 5 and fit snugly on the shaft. To connect the armature coils with the commutator proceed as follows: With a fine-toothed hack saw cut a nick about $1/16$ in. deep in the end of each commutator bar on the side nearest the coils. Now solder the loops to alternate bars, keeping them in their proper order. Be sure to use a non-corrosive soldering flux. One element of the winding is in heavy lines, Fig. 6, clearly showing the proper connection of the loop to the commutator segment between the bars connected with the beginning and end of the coil. When the connections are complete, center the armature in a lathe and take a very light cut

off the commutator, removing the superfluous solder. On the opposite end of the shaft is a brass thrust sleeve, which should be a snug fit and be pressed on the shaft.

The top bearing and brush holder are shown in Fig. 7. The bearings are turned from a piece of brass or phosphor bronze rod. Both bearings are of the same dimensions. The brushes are of $1/4$ -in. square carbon, held in two pieces of square brass tubing. The tubing is sweated to an 8-32 brass screw 1 in. long and set at such an angle that the brush is at right angles to the commutator. Each brush holder is insulated from the bearing bracket by two fiber washers, one on each side of the bracket as shown in Fig. 7. Now clamp the bearing bracket, field laminae, and hard wood ring, Fig. 8, rigidly together by means of the two $1/4$ -in. bolts, which should be cut off to $2\frac{1}{2}$ in.

The lower bearing is to be set in the center of the top of the fan case and secured by means of two small brass screws. A small brass oil tube about $1\frac{1}{2}$ in. long is soldered to the oil hole in the bearing and brought out through a hole in the hardwood ring. On the underside of the bearing is a dust cap, which consists of a felt washer 1 in. in diameter covered by a cap about $1\frac{1}{8}$ in. in diameter. The top of a small paper fastener will serve the purpose well. The dust cap is on the underside of the top of the fan case. The connections are shown in Fig. 9.

The motor is now complete and should be tested out. If it runs in an anti-clockwise direction the field leads must be reversed so that the armature will rotate in a clockwise direction.

(To be continued)

Connecting a Spotlight in an Automobile Dynamo Circuit

A SPOTLIGHT was wanted on an automobile in which the lights were on a series circuit. As the spotlight was only to be used occasionally the method of wiring was as follows: A single switch was mounted on the dash and a wire connected with it from the left hand terminal on the back of the ammeter. Another wire from the switch was connected with the spot lamp and grounded to the other terminal of the spot lamp. If a spot lamp is procured with a switch on it, it is only necessary to connect a wire from the ammeter to the lamp and ground the lamp.

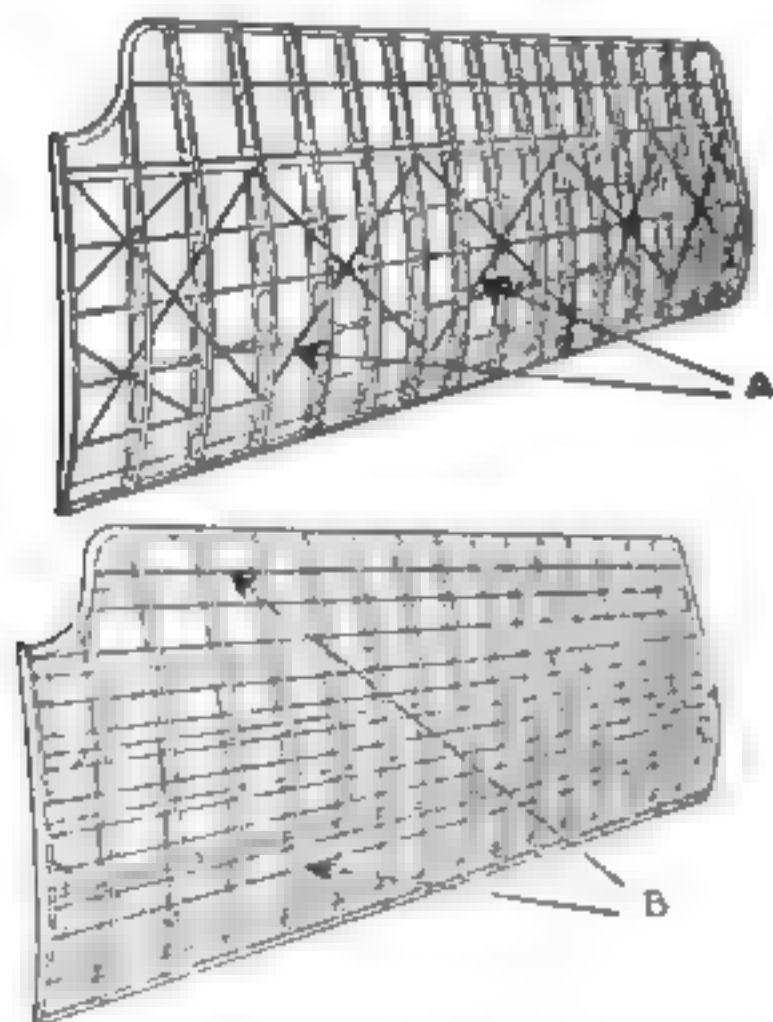
Blackboard an Adjunct to the Amateur's Shop

A BLACKBOARD is a valuable adjunct to the amateur's shop. One may easily be made of a sheet of cardboard painted with a mixture of lampblack and gasoline and then tacked in a convenient place on the shop wall with crayon box nearby.—HAROLD W. OFFIUS.

A Grid Placed in the Wings of an Airplane

IN wireless telegraph work on airplanes there is often difficulty encountered in obtaining sufficient metal work to serve in a balancing capacity.

In the construction the bracing wires of the wings are so connected that they provide a good path throughout the whole length of the wing, through which they are led to the wireless transmitter. To prevent air friction, additional wires are mounted inside the wing frames which are connected with the bracing wires. These wires are supported by lashings through the slots in

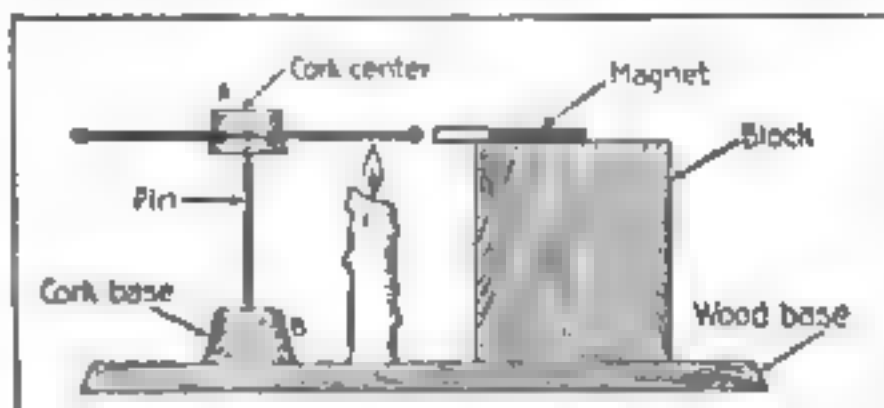


Wires making the grid for an aerial are placed in the frame of an airplane wing

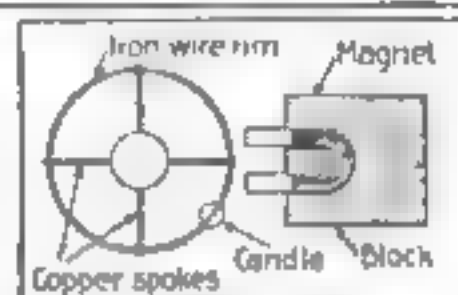
the ribs. As these wires form a grid they are placed parallel and are of equal lengths. In the illustration the bracing wires are shown at *A*. They may be either bare or insulated. At *B* is a modification of a grid, the wires being supported by lashings through slots in the ribs.

A Simple and Interesting Thermo-Magnetic Motor

A VERY simple thermo-magnetic motor which utilizes the principle that heating a piece of metal weakens its magnetic properties, can be easily built. The rim of



The wheel rim is heated by a lamp to reduce the magnetic properties of the parts close to the magnet



the wheel that revolves is made of a piece of heavy iron wire, which is held together with copper spokes fitted in a cork *A*. Through the center of this cork a large pin is placed, about which the wheel rotates. The lower end of the pin is stuck into another cork *B*, which is glued to the base. A strong horseshoe magnet is then supported on a block of wood near the rim of the wheel as shown. A small alcohol lamp is then placed under the rim of the wheel, care being taken that it is not placed too near the magnet poles, as it would heat them and destroy a large part of the magnetism contained in them.

As soon as the portion of the wheel directly over the lamp becomes heated, the wheel will begin to turn, the heated portion revolving away from the magnet. This is because the heated portion has lost some of its ability to be attracted by the magnet, therefore it moves or is pushed away by the cool metal.—ALEXANDER V. BOLLERER.

An Undercoating for Copper to Hold Paint

COPPER does not hold paint well, hence it must be treated with some substance that will take the paint, or left to weather a year or more. A good primer is boiled linseed oil, to which add a little Japan gold size. Apply one coat and let it stand about one week, then apply the paint over it.



FOR PRACTICAL WORKERS

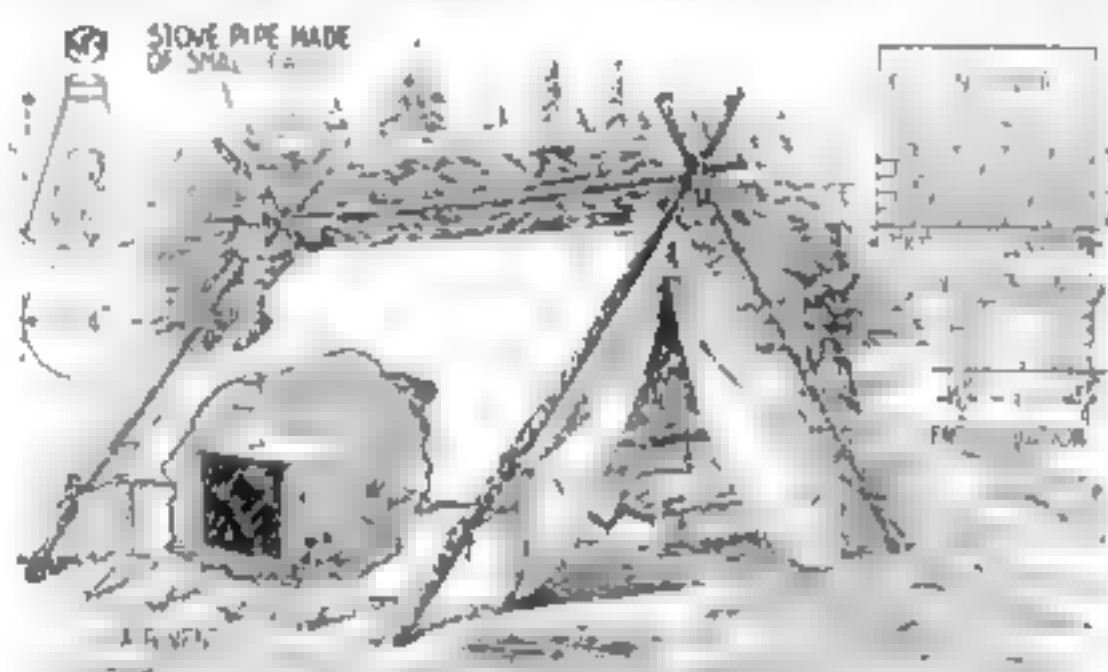
Warming Army Tents With Improvised Stoves

BEFORE the United States Government issued tent stoves to the Guardsmen on the Border, there were many improvised stoves or heaters to be seen in the various tents. The stove shown in the upper left corner of the illustration is the type known as the Sibley tent stove, which is the one issued by the Government to keep the boys warm. There were some stoves made along these lines and in use before the Federal authorities considered it cold enough to issue them to the men. These stoves were roughly shaped from sheet iron and riveted together. Another popular stove, which is made from a 5-gal. kerosene can or a 25-lb. coffee can, is shown in the corner of the tent. Two small holes about $\frac{1}{2}$ in. in diameter, are cut near the bottom for air vents and a hole about 4 by 8 or 6 by 6 in. is cut in the front to allow the insertion of fuel, another hole being cut to carry off the smoke and allow for perfect draft. The fire is regulated by placing a piece of tin over the fuel or fire opening and another over the air vents in the bottom. When starting the fire the air vents are left open and the fire opening is kept covered. When the fire gets well started it may be checked by opening the slide over the fire opening or removing it altogether, or the vents at the bottom may be closed and the slide on the fire opening left closed or partially open.

A very simple brick stove is shown in the upper right corner of the illustration. The bricks were laid up with mud for mortar, the whole thing requiring less than 50 bricks. The stove served as a cooker as well as a heater, for food could be readily heated on top of the tin or iron cover.

The worst problem of all was to get the required amount of stovepipe, but in several instances this difficulty was overcome by using empty vegetable cans. These are plentiful about a camp. The only trouble with this style of stovepipe lies in the fact

that the cans act on the same principle as a muffler on a gasoline engine and thereby fail to accomplish the desired results, as the smoke is held in check and a slow smoky fire results.—GEORGE M. PETERSEN.



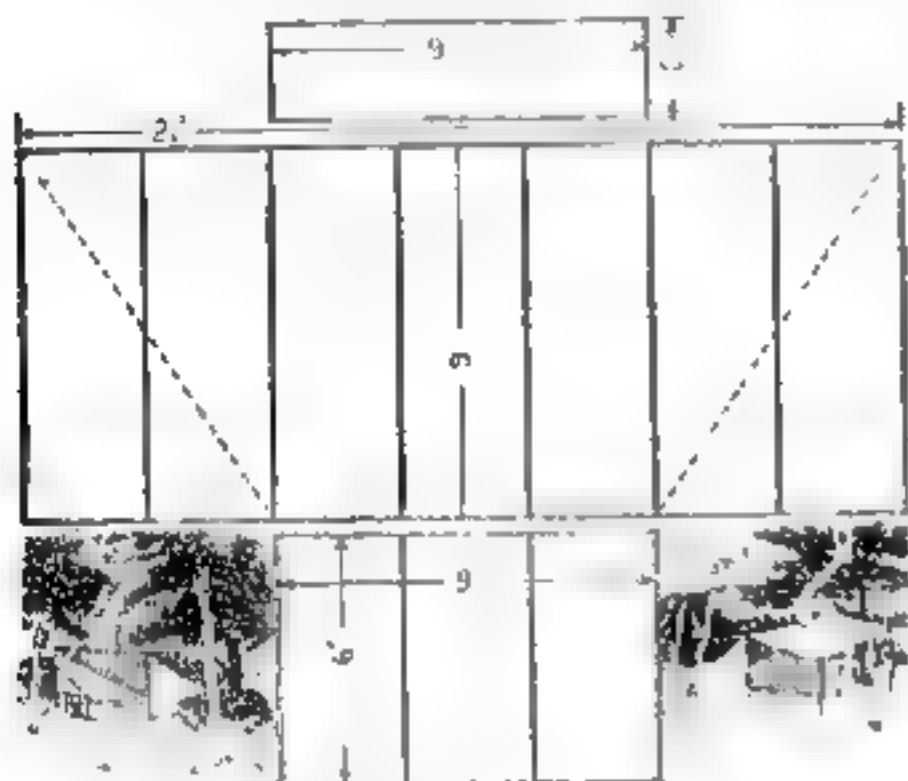
Three types of roughly improvised stoves for heating the tents of the guardsmen on the Mexican border

Stropping a Razor on the Fleshy Part of the Hand

THE finest strop for a razor is the fleshy part of your hand below the little finger. For eight years I have used no other for razor blades. If it is a safety razor blade grasp it between the thumb and first finger of the right hand and strike finger nail and blade at the same time on the fleshy part of the left hand. If you will do it slowly at first the motion becomes automatic. I put a little vaseline on the cutting edge. This keeps the blades constantly in first class condition.—JOHN W. SHANK.

Making a Campfire Tent out of a Pack Cloth

THE campfire tent shown in the illustrations is most comfortable to live in. It is of the open front type and is always well ventilated. With the front flap raised as an awning, the heat from the fire is reflected



Dimensions of the cloth for making an open front campfire tent equipped with an awning

inside, where it is most welcome on a cool night.

This tent may be made of the simple lean-to type, or with the front flap. The model with the awning is a nice roomy tent for two or three persons. All models are easily made from a rectangular piece of material, and merely folded on the dotted lines. This makes it unnecessary to cut the material up, and when not in use the tent is folded out flat to serve as a tarpaulin, an apron to cover the canoe, or as a pack cloth to wrap around the blankets and other camp duffle. The two end segments, within the dotted lines, are folded in to serve as a sod cloth, and an additional strip of cloth may be sewed to the back wall to serve the same purpose. This is desirable, because it keeps out the wind and rain and prevents insects from entering.

As lightness is desirable, a heavy grade of unbleached cotton cloth is the best choice. If a heavier material is wanted, use regulation duck in 6, 8 or 10-ounce weights. Common khaki fabric is good, and stout enough for ordinary use. The breadths of cloth are sewed together by lapping one edge over the other about $\frac{3}{4}$ -in. and double stitching the seams. This can be done on the sewing machine. A 1-in. hem should be run around the edges.

The eyelets are sewed in by making a small hole at the proper place, and placing a brass ring or grommet on each side of the hole. Sew over and over with an over-casting stitch, using waxed seine twine or ordinary string.

Every tent should be waterproofed. The following method is one of the best: In 4 gal. of boiling water (rain water) dissolve $\frac{1}{2}$ lb. of common powdered alum. In a separate pail, dissolve $\frac{1}{2}$ lb. lead acetate (sugar of lead) in 4 gal. water. Pour the alum solution in a clean tub, and add the lead solution. Let this stand for several hours, then pour off the clear liquid and work the canvas thoroughly in it, so that every part of the cloth is well saturated. To make the cloth absolutely waterproof, it is necessary to fix the acetate of alum in the fibers of the cloth, and this cannot be done unless soft rain water is used. Finish by lightly rinsing in clear water to remove the dust of sulphate, and hang up to dry. An ordinary coat or sweater can be waterproofed in the same way, and cloth thus treated is fireproof also. Sugar of lead is a poison, but only when taken internally.

If the tent is wanted of a brown or forest-green color, the cloth may be easily dyed with Diamond Dye or other household dye. This should be done before waterproofing and after the tent is made up.

The tent may be staked with the usual ridge and side poles, with the crotched sticks cut in the woods, or suspended along the ridge with a rope, hung between two trees.—STILLMAN TAYLOR.

Preserving Flowers in Natural Colors with Wax

IT is not generally known that preserving flowers in wax is one of the easiest of tasks. Ordinary candles may be used. To prepare the wax, it is only necessary to cut the candles into chunks, being careful to remove the wicks. The wax is then melted in a saucepan over a flame, after which it is ready to receive the flowers. Each flower should be dry on the surface when treated; there should be no rain or dew-drops on the petals. Take the blossoms separately and dip them for a moment or so into the liquid wax, constantly moving them about. Immerse the blossoms completely and also an inch or so of the stem. Then take them out and hold until dry. Do not lay them on a table or flat surface until they are dry, as this will crush them.

How to Reline Your Automobile Brakes

An easy method of inserting new lining in a brake drum

By Joseph Brinker

MANY automobile owners who delight in tinkering around their cars and keeping them in repair would like to reline the vehicle brakes were they sure they could do it properly and not jeopardize their lives through poor workmanship. The drawings shown indicate the various steps necessary in properly relining a brake. First, jack up the rear axle of the car and remove the rear wheels as per the instruction book furnished by the car maker. At

about $1\frac{1}{2}$ in. from the external measurement to get the cutting length of the lining for one internal brake. This is shown in Fig. 1.

Then put the band in a vise as shown in Fig. 2 and chisel off the heads of the old rivets. In marking the new lining for the rivet holes, lay the wheel on the bench or floor with its hub side down. Put the lining and band in place as shown in Fig. 3 and wire the band in place. Then with a



Fig 1

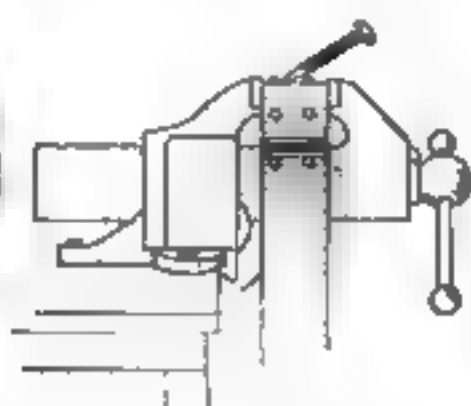


Fig 2

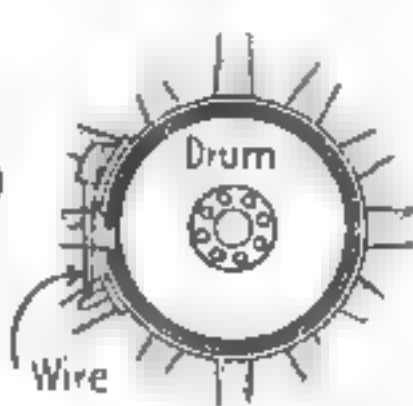


Fig 3

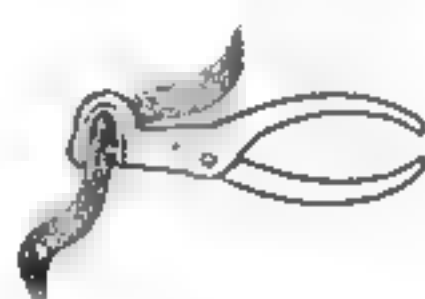


Fig 4

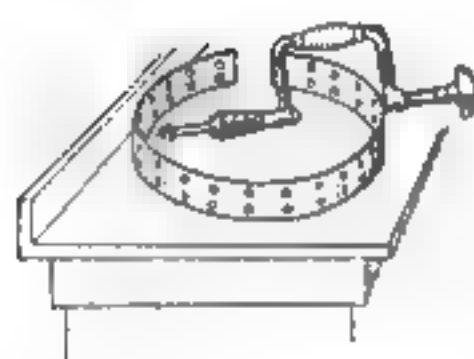


Fig 5

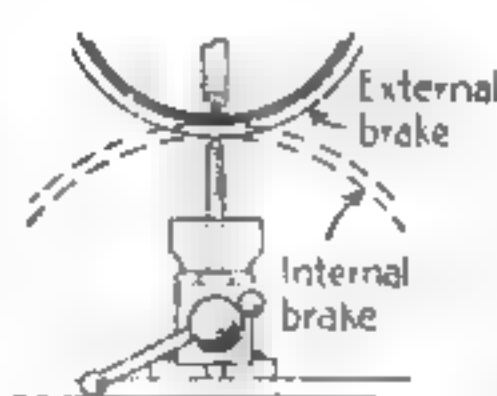


Fig 6

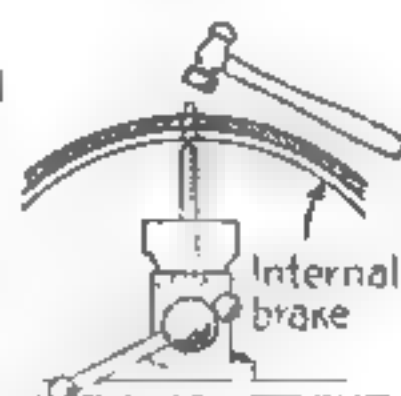


Fig 7



Fig 8

Cutting the length of a new brake lining, marking the places for the rivets, punching and countersinking the holes, placing the rivets, hammering them to a head and applying the band

the same time disconnect the toggles and remove the brake clevis pin, the adjustment screw and the various coil springs attached to the brake-band. Then remove the band, keeping in mind the top and bottom of the assembly. Clean all the parts thoroughly with gasoline and remove all the old grease around the brake dust-guard and the axle-stub.

Buy the new lining in one piece but do not attempt to cut it until the brake has been removed. To obtain the correct length, measure around the outside of the external brake-band with a tape, allowing an overlap of about $\frac{1}{2}$ in. so that the lining is not short at the band opening. Deduct

soapstone stick or pencil, mark the position of the holes in the new lining, using the holes in the band as a template. Then cut the holes with a leather punch similar to that shown in Fig. 4

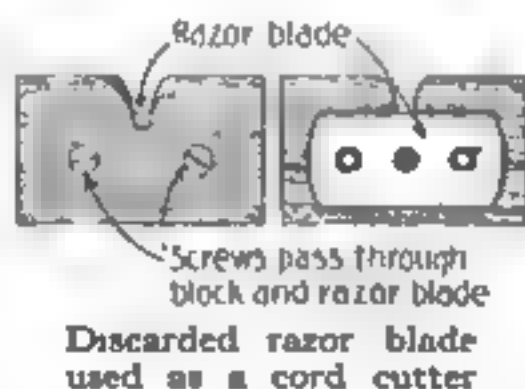
Place the band and lining together in a vise or on a bench as shown in Fig. 5, holding the lining in place by several small bolts inserted through corresponding holes. A wood countersinking bit and a brace will serve for countersinking the holes in the lining so that the rivet heads will be below the lining surface.

After that is done insert a rivet through a corresponding hole in band and brake and place the countersunk head of the rivet on

top of a bolt fastened in a vise as shown in Fig. 6. Insert a short piece of pipe over the free end of the rivet and tap the top of the pipe with a hammer to draw the rivet head and lining tightly in place. See that the end of the rivet extends about $3/16$ in. through the band. Then rivet over the heads with light, sharp blows of a hammer. The method of doing this for the external brake is shown in Fig. 6 and for the internal type in Fig. 7. Care should be taken in marking off the lining holes or, in case of the external brake, the lining may tend to cut corners as shown in Fig. 8. This may be avoided by leaving the holding-in bolts in place in lining and band until the other holes are filled with rivets.

A Cord Cutter Made From a Safety Razor Blade

THIS cord cutter consists of a discarded safety razor blade and a block of wood. If the cutter is to be used on the counter edge the block of wood should be considerably thicker than the counter top. The lower edge of the block is placed flush with the underside of the counter allowing the extra thickness to project above the upper surface, which is notched in the center and cut slanting toward both ends. It is then fastened with two wood screws run through the holes in the razor blade. This manner of fastening allows a small portion of the blade to extend in the notch where the cord will strike it upon being drawn in the opening.—THOMAS DEAN.



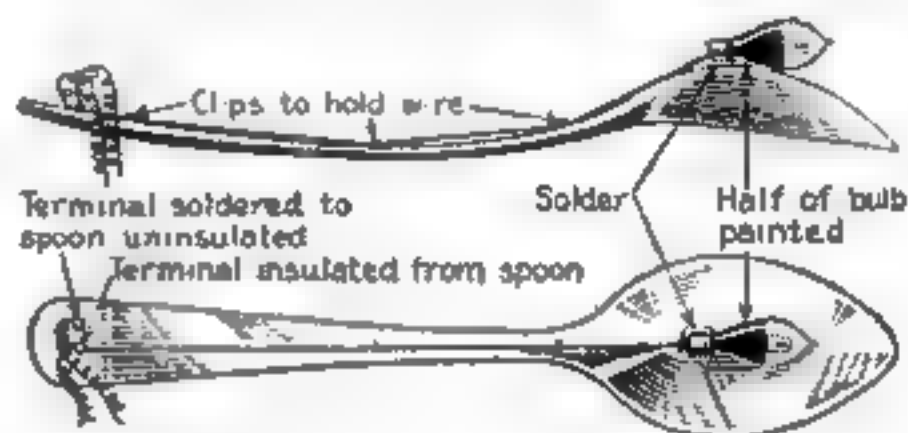
Electric Lamp Attached to a Spoon for Tongue Depressor

WHEN it becomes necessary to examine the throat of a child, or to remove a lodged fishbone or button, a spoon is the first thing sought for to depress the tongue in order to make the examination. A good light is also necessary. To furnish one for the purpose, a small electric light may be attached to the back of the spoon.

This lighted spoon is not difficult to arrange. It requires only an ordinary spoon, a small two-volt lamp, a dry cell, a few inches of enameled wire—about

18 gage—one insulated and one uninsulated binding post and 3 or 4 ft. of flexible cord.

Scrape enough enamel from the ends of the wire to allow for soldering to the lamp and attaching to the binding post. Attach the posts on the end of the spoon handle. Solder the base of the lamp to the



A small electric globe fastened to an ordinary table spoon for examining the throat

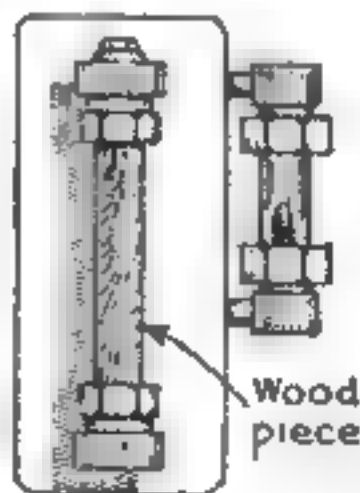
spoon bowl and the end of the enameled wire to the center button of the lamp. Connect wire attached to the center button on lamp to the insulated binding post. Enamel the base or back part of the lamp so that the light will be reflected into the throat and not into the operator's eyes. Attach the flexible cord to a battery and to the binding posts, and the spoon is ready for use.

If carefully made, this will prove to be an invaluable addition to the "first aid" equipment of the medicine cabinet. The spoon with the attachment can be sterilized in hot water.—E. A. WARNER.

Temporary Repair on a Broken Lubricator Filling Glass

A STEAM shovel located at a great distance from a repair shop had a broken lubricator filling glass. There were

no extra ones on hand. The sketch illustrates how a small piece of wood was whittled and substituted for the glass. Though this did not register the use and supply of oil in the lubricator, it plugged the openings left by the broken glass satisfactorily and held very nicely until new glasses arrived several days later. The wood should



A wood plug substitute for glass

be cut as round as the glass to make a close joint at each end in the fittings. The nuts should be made secure.—F. W. BENTLEY.

Sheet Metal Working Simply Explained

V. Method of finding the miter lines and laying out the pattern for ninety degree elbows of any number of pieces

By Arthur F. Payne

Director of Vocational Education

SINCE the publication of the article in the September issue describing the method of laying out elbow patterns, many inquiries have been received asking for the method of finding the miter lines and laying out the patterns for elbows having any number of pieces. The author and publishers are very glad to receive this indication of interest in the series and are especially glad that it is in the scientific side of the work. They will welcome further suggestions.

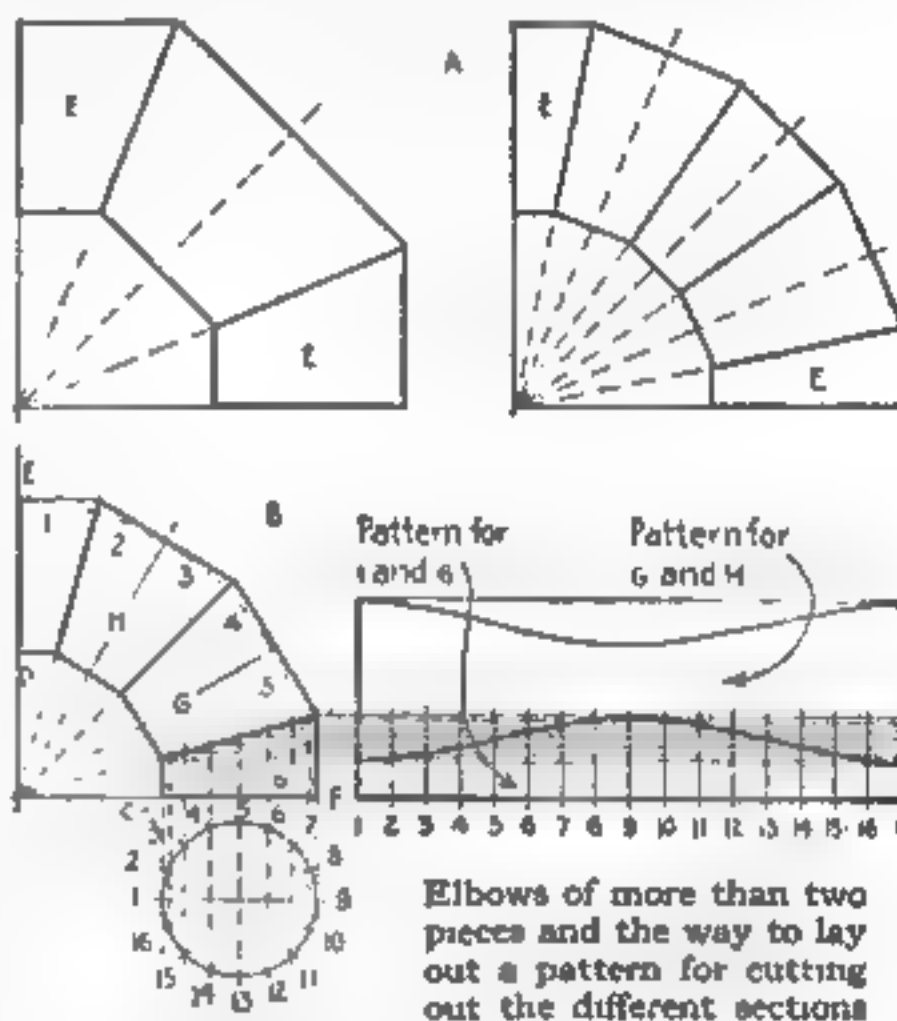
Almost every pattern drafter has his own pet way of laying out the many pieced elbows, and various ingenious charts, dials, disks, tables, etc., have been worked out and placed on sale. However different these may appear, one from the other, they are all based on the same fundamental methods and principles.

In all elbows of more than two pieces, the two end sections should be one-half the size of the other sections. Note the end sections of the drawings showing the elbows in *A*. It is only necessary to develop the pattern of the bottom end section. This can be used for a pattern for all of the other sections, as will be shown later in the description. It is necessary to lay out the drawing for the complete elbow with all the miter lines to get the correct miter line of the end section. This extra work can be avoided if you will make one of the miter lines charts as shown and described later in the article.

It is always understood when speaking of elbows that we are referring to elbows of 90 deg. In the drawing *A* we have two elbows, one made of three pieces and the other of five, but both are 90 deg.

For an explanation of this entire problem we will take a four-piece elbow. Draw two arcs, as shown by the dotted lines *C-D* and *E-F* in drawing *B*. We already know that the two end sections are to be one-half size of the center sections. As there are four pieces in the elbow the two center sections will be twice the size of the two ends, as shown. If we take the size of one end section as a unit we find that

it is repeated six times in the entire elbow. Then we must divide the arcs *C-D* and *E-F* into six equal parts. Another way of stating this is: There are four sections in this elbow; there are two end sections and two center sections. Count one for each of the end sections ($1+1=2$). Add two for each of the center sections ($2+2=4$), making a total of six units. This rule



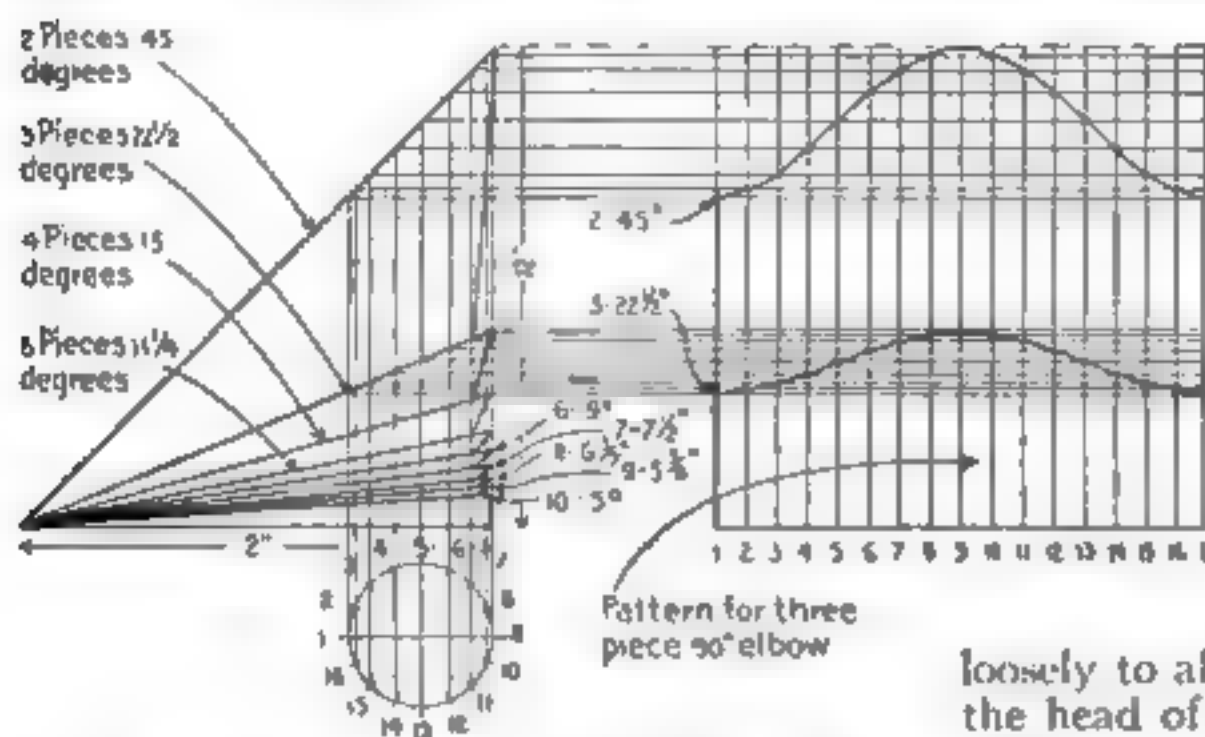
applies to all 90 deg. elbows of any size and any number of pieces.

The method of developing the pattern for the elbow in *B* is shown and has already been described in the June and September articles. It will save considerable time when laying out these elbow patterns in practical work if you will make from a piece of heavy tin one of the miter charts as shown in the drawing. This chart will give you the miter line of the bottom end section of the elbow and all you need to do is to develop the pattern for the pipe of the diameter wanted.

To make this chart, cut out of heavy tin a triangle that is 12 in. on two sides, as shown in the drawing, then with a protractor lay off the angles as indicated

in the drawing and table. A good protractor can be purchased very reasonably. Cut out the pieces as shown on the right edge of the chart.

To use this chart, lay it flat on the



A miter chart to keep at hand for designating the miter line of the bottom end section

paper and make a dot at the point where the lines meet. Draw a pencil line along the bottom and along the short line on the right edge that is marked for the number of pieces wanted. Remove the chart and connect the dot and the short line. This line will be the miter required. At the bottom, draw a circle the diameter of the pipe wanted and project the lines upward and over to the right to develop the pattern as described in previous issues.

For greater clearness we will give the table form, the numbered degrees for the miter lines for the indicated number of pieces as shown on the chart.

MITER LINES FOR NINETY DEGREE ELBOWS

For a Two-Piece Elbow,	45	Degrees
For a Three-Piece Elbow	22 1/2	"
For a Four-Piece Elbow	15	"
For a Five-Piece Elbow	11 1/4	"
For a Six-Piece Elbow	9	"
For a Seven-Piece Elbow	7 1/2	"
For an Eight-Piece Elbow.	6 3/4	"
For a Nine-Piece Elbow.	5 3/8	"
For a Ten-Piece Elbow	5	"

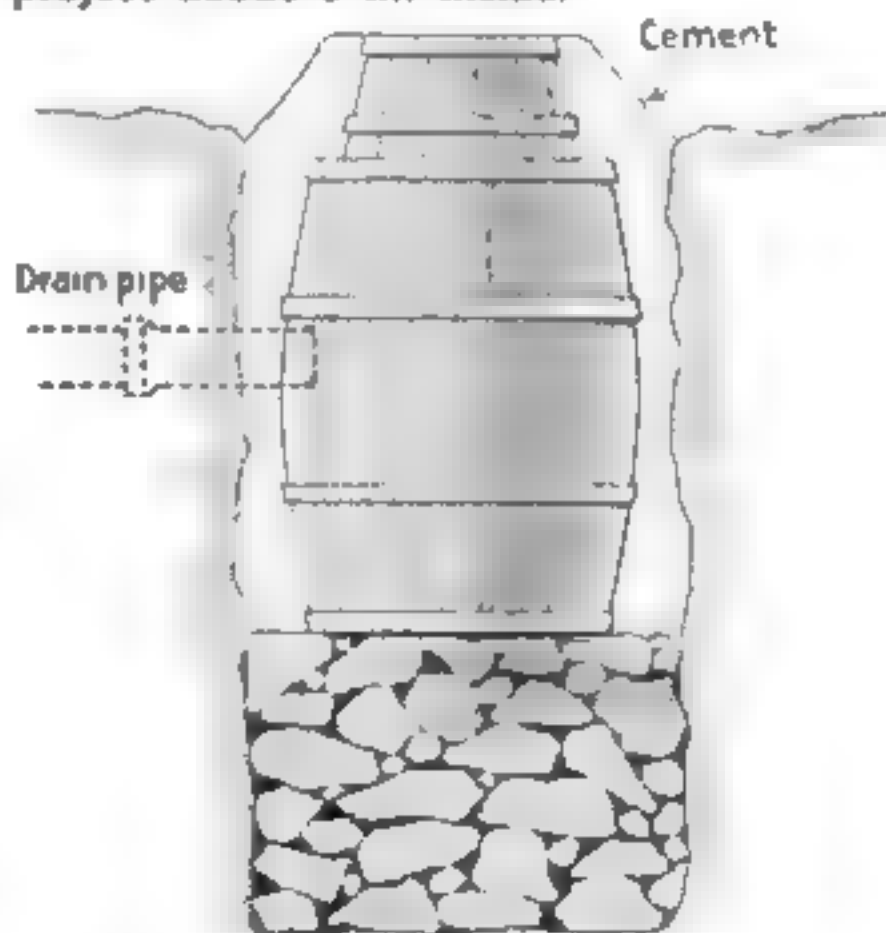
Ingredients That Make the Best Kind of Glue

THERE are two kinds of constituents in glue—glutin and chondrin—the one or the other in large quantities according to the raw stock used. Skins will produce more glutin and bones yield a larger amount of chondrin. As a cement, the glutin has the greater binding power and naturally is the more valuable.

An Inexpensive Cesspool Made of a Barrel and Cask

A SERVICEABLE cement cesspool can be constructed in the following manner at a cost of about three dollars. The essentials are a large crockery cask that stands about 4 ft. high, half of a lime cask, three or four bags of cement and plenty of clean sand and loose stone. Dig a hole about 8 ft. deep and 18 in. larger in diameter than the extreme diameter of the crockery cask. Fill this hole with about 3 ft. of stones or bricks packed

loosely to allow easy drainage. Knock out the head of the crockery cask and turn it bottom up, with the open end over the stones. Place it so the distance between the cask and the walls of the hole will be about the same on all sides. This will bring the turned up bottom of the cask about a foot below the surface of the ground. Cut a round hole in the side to admit the drain-pipe and set it in place, letting the end project about 6 in. inside.



A crockery barrel with an inclosed cask set in the earth to serve as a cesspool

Mix your cement in the proportion of 1 part of cement, 4 parts of sand and 4 parts of stone, bricks or clean clinkers. Fill in around the sides with this mixture and tamp well in place to remove all air pockets. Knock out the head from the

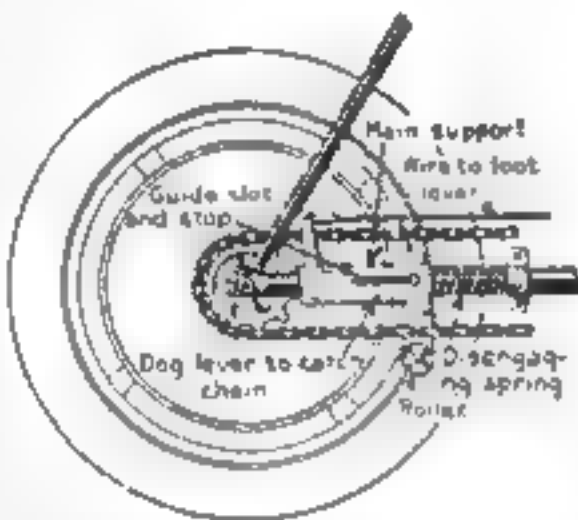
half lime cask and place it over the center of the bottom of the larger one. Mark around it with a pencil and saw out the resulting disk with a keyhole saw. Fit the lime cask in this opening and nail it securely in place. Arch over the bottom of the large cask and build up around the smaller one with a somewhat richer mixture of cement, about 1 part cement to 2 parts sand and 2 parts stone. In rounding over the edge of the large cask do not spread the cement less than 2 in. thick at any point.

For a cover, make a mold by nailing a barrel hoop around the edge of a barrel-head; lay in a few pieces of scrap wire, etc., to act as binders and pour in a 2 to 1 mixture of cement and sand. Insert an iron ring in the center for a handle. Allow this to set a week before removing the mold. After all has hardened at least two weeks fill in and cover with earth. Such a cess-pool has given good service for nearly six years.—L. B. ROBBINS.

Pedal-Operated Brake for a Belt-Driven Motorcycle

THE only brake that can be used on a belt-drive motorcycle is the friction clutch in the rear hub controlled by the starting pedals. Just to be more up-to-date I applied the attachment shown in the accompanying illustration to operate this brake with a foot-pedal.

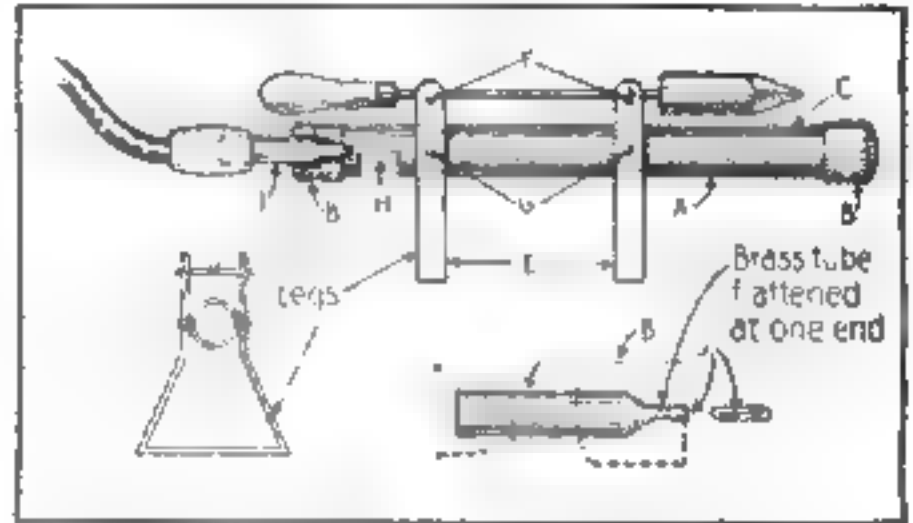
The main support of the brake is mounted on the frame-brace so that it will move freely. The wire to the foot-lever is attached to the extension on the dog, so that when pressure is applied to the foot-lever the lower part of the dog catches in the chain. The roller prevents the chain from pushing away from the dog. After the dog slips over a link-pin it cannot go farther. As the foot-pedal is pressed down the whole attachment moves forward on the frame-brace, pulling the chain backward and setting the clutch-brake. When the foot releases the pedal-lever the spring pushes the dog and support back.



A sliding dog on a motorcycle frame for a pedal brake

Making a Soldering Iron Heater of Pipe and Fittings

THE main body of the heater *A* is a piece of $\frac{1}{2}$ -in. iron pipe 12 in. long, threaded on both ends to receive a cap *B*.



Pipe and fittings as they are used to make a gas burner for heating a soldering iron

A portion of one end equal to the length of the soldering copper is perforated or drilled to produce two rows of $\frac{1}{16}$ -in. holes at *C*. Located in the center are two feet or supports to raise the heater from the bench surface. These supports have the form shown at *E*. These are made of sheet metal about $\frac{1}{16}$ in. thick and $\frac{3}{4}$ in. wide. Holes are drilled near the top of these pieces and nails *F* inserted to form a rest for the iron. The supports are secured to the pipe with machine screws as at *G*. At the opposite end of the pipe a small piece is cut out as at *H* to supply the necessary air to the gas.

The nozzle for the gas jet is made of a piece of $\frac{3}{8}$ -in. brass pipe about 3 in. long, flattened at one end as shown. A hole is drilled in the cap for this end of the main pipe and the piece of brass inserted with nozzle end in and near the air inlet notch. A rubber tube is used to connect the heater with a gas supply pipe. If the heater gives a large white flame the end of the brass tubing *J* should be flattened more. The right flame can be determined by trial in changing the size of the opening.

A Durable Paint for Surfaces Exposed to the Weather

SEVERAL tests made with paint on boards showed that a mixture of one-third zinc white and two-thirds barites was the most durable. The large amount of oil required prevented the reaction of the zinc, but the paint was deficient in body, hence in covering quality.

Clip for Carrying Pipe in the Vest Pocket Safely

A GREAT number of pipe users adhere to the straight stem for reasons known to the habitual smoker. However, carrying such a pipe is somewhat difficult.



A clip similar to the one used on a fountain pen for holding pipe in the vest pocket

If carried in the hip pocket it is liable to be broken, and if in the vest pockets it is liable to be dropped out and lost. For the worker who likes to and can have a frequent draw, it is most readily carried in one of the upper vest pockets. The illustration shows an easily made aluminum or brass clip that is bent to fit the stem of the pipe and which will securely fasten the pipe to the edge of the pocket. The idea was conceived after the writer had lost a few broken-in good ones, himself.—F. W. BENTLEY.

A Silvering Process for Glass Instruments and Mirrors

DISSOLVE 2.5 grams of silver nitrate in 100 c.c. of distilled water, and add ammonia until the precipitate just goes into solution. Make up the solution to 250 c.c. When this has been done, prepare another solution containing .5 gram of Rochelle salt in 250 c.c. of water; boil the solution to dissolve the salt more rapidly. Keep both solutions in tightly stoppered bottles in the dark when not in use.

The surface to be silvered must be thoroughly cleaned by washing first with

a strong alkali solution, then with dilute nitric acid, and finally with distilled water. After each washing, the surface should be rubbed with moist cheesecloth. A solution of stannous chloride in water to which a few drops of hydrochloric acid have been added is then poured gently and evenly over the surface, which should then be well washed in tap water. Care should be taken not to touch the prepared surface with the fingers after the treatment with tin chloride.

While still wet the object is placed in a waxed dish or waxed paper, and a mixture of equal volumes of the two solutions already prepared quickly poured over it, avoiding splashing and air-bubbles. In about an hour the silvering will be complete; the liquid may be poured off, and the article dried. The silvered surface should never be touched by the fingers.

The best shellac for such a surface is prepared by dissolving 5 parts by weight of gutta-percha; 20 parts by weight of gum damar in 75 parts by weight of benzene. If these articles are not readily obtainable, the surface may be varnished with a very dilute shellac varnish. By this process anyone can easily construct hygrometers, mirrors, reflectors, and many other kinds of useful apparatus.

Holding the T-Square on the Drawing-Board

WHEN using a small drawing-board not supported by a stand or other regular holding arrangement, the most convenient position in which to hold it while seated is to tilt it against the edge of the table.



A cord on T-square head to hold it on board

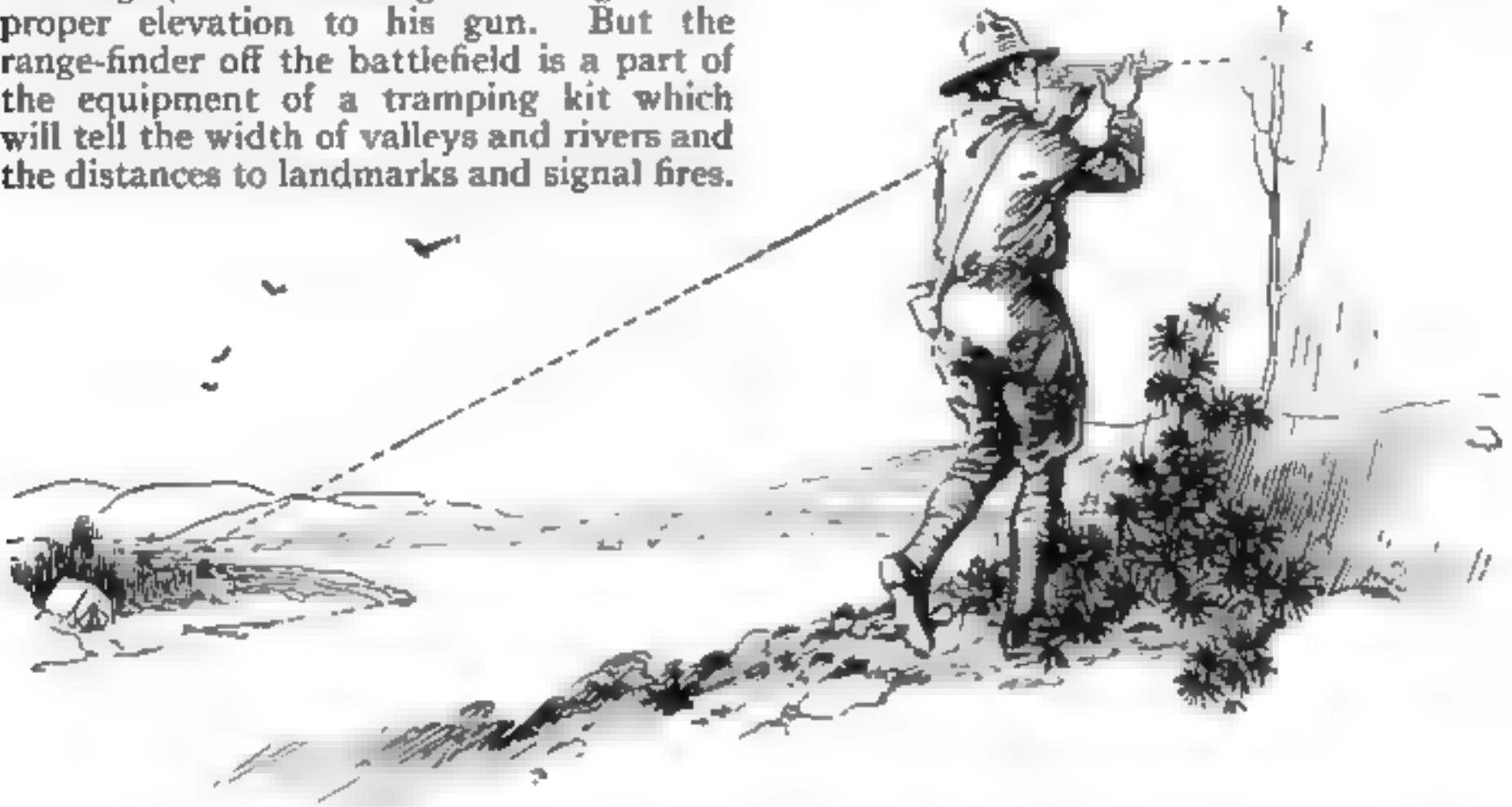
As a result, the T-square must be dropped to the base after each time it is used. The illustration shows how a simple attachment

for the board and square can be made and applied which will hold the square at all times in place on the face of the board. A number of very small screweyes, two light rubber bands, and a piece of light but strong cord are all the materials needed. It is easily pushed up and down as required, and does not interfere with the placing or withdrawal of work.

Range-Finder to Locate Landmarks and Signal Fires

WE NATURALLY think of a range-finder as that part of a gunner's equipment which tells him the distance to his target, thus enabling him to give the proper elevation to his gun. But the range-finder off the battlefield is a part of the equipment of a tramping kit which will tell the width of valleys and rivers and the distances to landmarks and signal fires.

until the two inside edges of the images are parallel to the thin edge of the wedge. When the one image-edge is *in line with* the wedge's thin edge, the image-edge in the other mirror should also be in line with it. The image positions should appear as



A range-finder suitable for the woodsman or camper to aid in locating landmarks and computing their distances or the width of rivers and valleys. It is made of odds and ends of scrap

Any boy can make his own range finder from materials that might otherwise go to the scrap-heap.

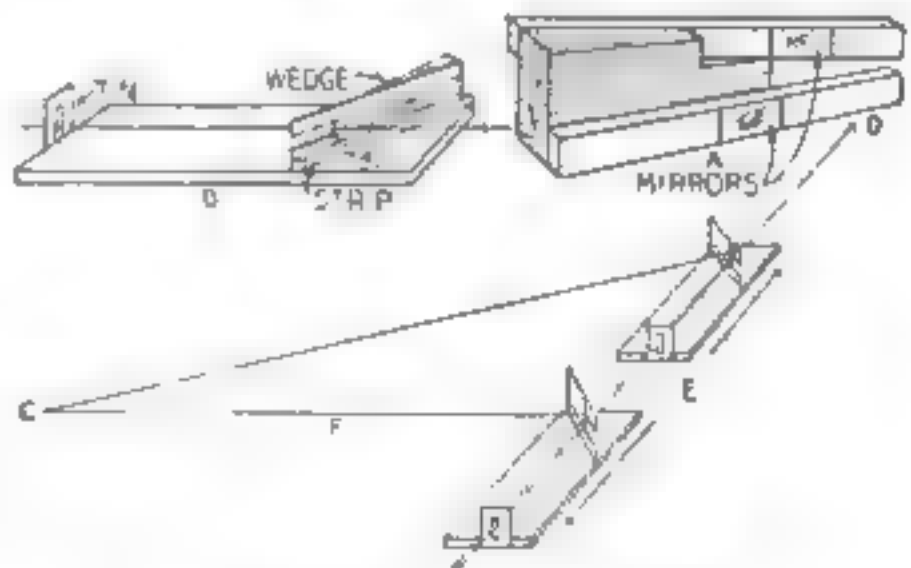
The essential feature of the device is shown at *A*. This is cut from a wedge-shaped piece of wood 2 in. long, $1\frac{1}{4}$ in. wide, and $\frac{3}{32}$ in. thick. From the thick end it is tapered to a very thin edge at the other end. Cut away a piece $\frac{1}{2}$ -in. wide extending from the thin end to $\frac{1}{3}$ the way toward the thick end.

Two strips $3\frac{1}{4}$ in. long and $\frac{1}{2}$ in. wide are cut from a good quality of thin mirror, and they are fastened to the prepared wedge of wood with bits of beeswax. Both mirrors face toward the front as shown.

Lay the mounted mirrors face-up on the floor, slipping something under one side of the wedge so that the lower mirror will be level. Cut from stiff white paper a piece exactly 2 in. square, then hold it in a horizontal position just 20 in. above the thin edge of the wood wedge, peering down at the mirrors through a hole punched in the center of the paper square.

Two images of the card will be seen, one in each mirror. Slip the card along, keeping it 20 in. from the wedge-edge, rotating it

indicated by the shaded portions in the mirrors. If, however, the images overlap, then the mirror strips are too nearly parallel; if they do not touch, then the angle between the mirrors is too great. In either case the angle between the mirrors must be corrected by pressing the mirror strips firmly against their beeswax pellets



A wedge shaped piece of wood with thin mirrors attached is fastened to a baseboard

until they fulfill the alinement test at the 20-in. distance. A little patience is needed. When successful take a stick of red sealing wax and a hot nail and wax the edges of the

mirror strips securely to the wood wedge, being very careful not to disturb the adjustment of the strips. Make the sealing wax very hot with the nail so that it will not break loose.

The other part of the work is easy. Cut from a board a piece measuring 8 in. long, $2\frac{1}{2}$ in. wide and $\frac{1}{2}$ in. thick, and nail a wood strip of $\frac{1}{2}$ -in. square cross-section across one end at a 45 deg. slant. Glue the wood wedge against this strip so that the mirrors stand as in *B*, facing away from the supporting strip.

To complete the range-finder cut a piece of tin $1\frac{3}{4}$ in. square. Cut into it a slit 1 in. long and $1/64$ in. wide and tack the tin against the end of the baseboard so that the slit and the thin edge of the wood wedge are parallel and the same distance from the side edge of the board.

The distance of an object, *C*, may be determined as illustrated. Turn the left cheek toward the distant object and, looking straight ahead, hold the slit of the range-finder close up to the left eye and look through the slit into the mirrors. Point the instrument in such a direction that the image of the distant object, as seen in the upper mirror, lies exactly above and directly in line with the thin edge of the wedge. At the same instant, glance past the wedge-edge and note some feature in the landscape which is in line with this edge, a tree, *D*, for instance. Now with the eye at the slit walk directly toward this object, *D*, counting the number of paces taken, still keeping the wedge-edge in line with the tree. Meanwhile the image of *C* in the upper mirror moves on out to the right and at the same time its image as seen in the lower mirror moves up from the left until it in its turn comes into line with the wedge-edge. At the instant this happens note how many paces, *E*, have been taken from the first observing station. Multiply this number by 10 and you have the number of paces, *F*, from the first point of observation out to *C*. If you have learned to make a stride of 36 in., then the distances are known at once in yards, otherwise you must know the length of the natural stride before you can obtain distances in yards. Of course the paced distance can be measured with a tape-line. If the paced distance is 88 yards then *C* is 880 yards or half a mile away.

It is evident that to measure with this instrument the distance to an object 5 miles away one must pace off half a mile. This

is sometimes inconvenient. It is therefore desirable, for objects at this distance, or farther away, to use a range-finder whose wedge is of only half the angle described above; the 2-in. paper square must then be held at a 40-in. distance in adjusting the mirror strips. The paced distance is then to be multiplied by 20.

This type of range-finder yields astonishingly accurate results if it is equipped with good mirrors. It is a scientific instrument based upon the laws of reflection of light and surveyors' triangulation methods and is worthy of any boy's serious consideration.

A Convenient Pivoted Card File for the Desk

FILING systems are necessary in all lines of business, and for convenience of small accounts or for data a single tray is often applicable. The desk tray illustrated is especially designed and it fits into a slide made for it, so that it is never



A desk card file tray pulls out the same as a drawer and turns on a pivot when drawn

in the way. Another feature of the tray is that it turns on a pivot and the cards face the person sitting at the desk.

Flanged bottoms hold the guide cards in place. There is a follower-block, simple in construction and operation, that holds the tabs in a readable position. Side tabs, as shown at *A*, permit more distinctive subdivisions. With each closing of the drawer an automatic angle-block tilts the cards back parallel with the follower-block. To further facilitate reference the index drawer is pivoted to its carrier-shelf.

The frame of the drawer is made up of two thick ends to which thin bottom and side pieces are nailed, the exact dimensions of which depend upon the size of the cards as well as upon the materials at hand. To the front end block, planed to serve

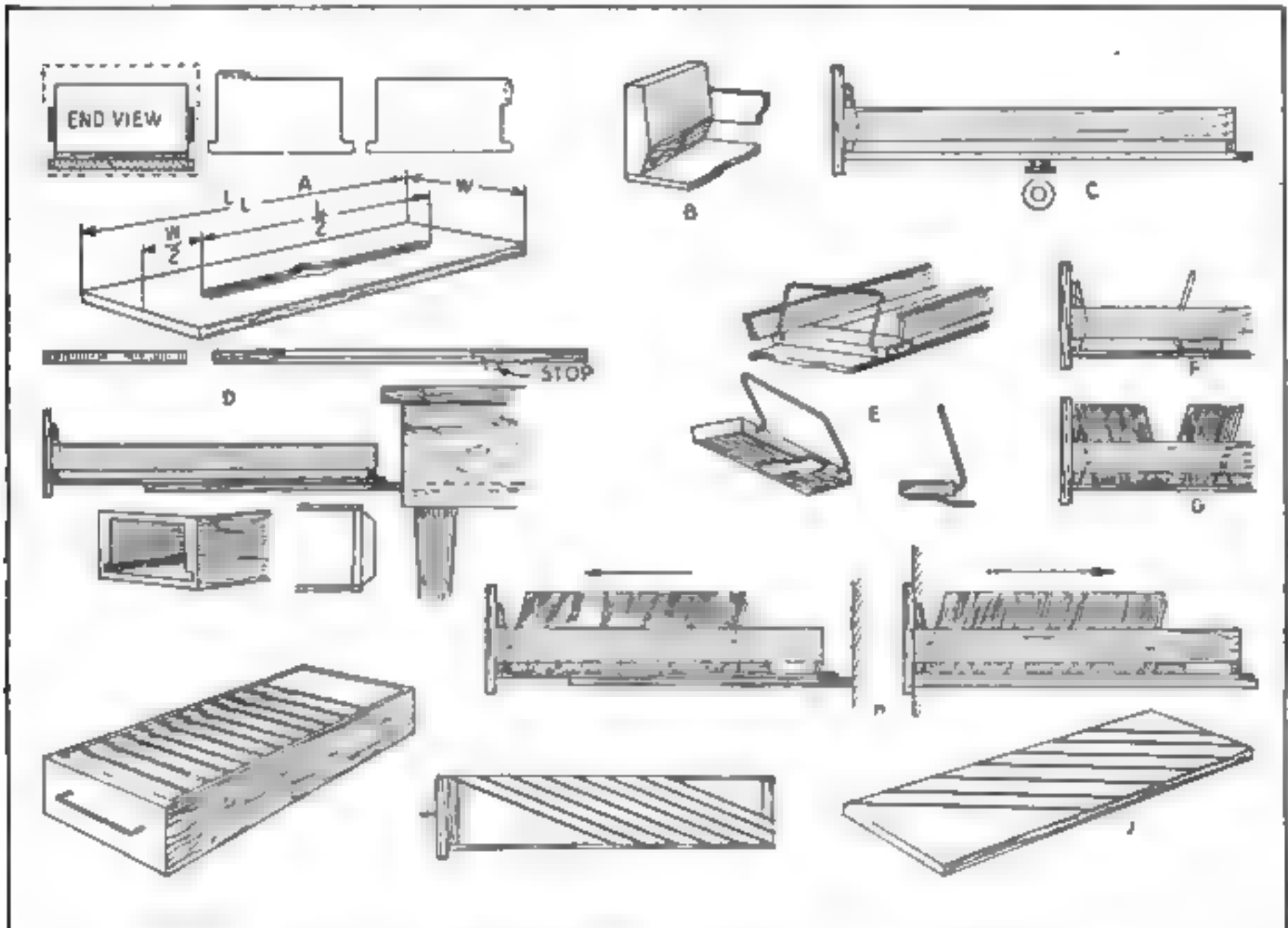
as the angle-block *B*, the drawer face and handle are fastened. A pivot wheel *C* is nailed to the center of the drawer bottom. This wheel fits into a slot in the carrier-shelf *D*. The follower-block *E*, made of a wood base to which a spring and wire brace are fastened, slips under the side pieces of the drawer. Pushing it against the material filed causes it to grip fast. It is released by a slight vertical pressure.

The most important part of this file is the angle-block. Usually the first tabs of an index are not visible, being wholly or

If, instead of cards, manuscripts, themes or large size envelopes are to be filed, the drawer shown in *I* will prove a better arrangement. Cardboard shelves are slipped into the kerf grooves and form pockets for filing.—EDWARD R. SMITH.

Three Methods for Finding a Chosen Card

FOR this trick the chosen card must be worked to the top of the pack. If it is there already, well and good; but if not, it



Details of the file parts which are made up to slide in an opening in a desk after the manner of a drawer, the front and follower block holding the cards in a tilted position

partly concealed by the face of the drawer. The automatically operated block *B* of this file is cut to a bevel, the lower surface of which is parallel with the follower-block *F*.

Suppose that the cards are arranged as shown in illustration *G*. With the pushing of the drawer into its casing, as in *H*, the momentum of the cards tilts them back. When the drawer is pulled out the bevel prevents the cards from being thrown forward. In steel filing equipment this space between cards and drawer-head is an added protection in case of fire.

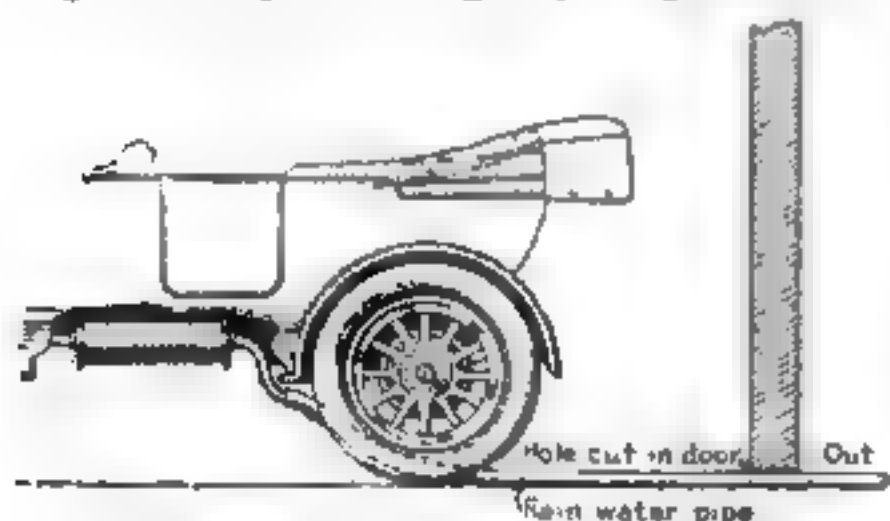
must be brought there by some means or other. This is generally an easy matter, even without sleight of hand, and can usually be effected under the pretense of looking through the pack. When the card is once at the top a false shuffle may be given, to throw the onlookers off the track. Then push the top card out sideways beyond the rest of the cards. Let the pack fall on the table. The resistance of the air will cause the top card to turn over and appear face upwards, all the other cards remaining face downwards.

Another method is as follows: Get the chosen card to the top of the pack. Slightly moisten the first and second fingers of the right hand, and take hold of the pack with the fingers above, thumb below. Jerk the hand containing the pack smartly downwards, at the same time relaxing the fingers, and it will be found that the entire pack falls to the floor, with the exception of the chosen card, which will stick to the moistened fingers. This will be the only card left and the card selected.

The third method is very similar to the preceding. The chosen card is worked to the bottom of the pack. Moisten the fingers slightly and take hold of the pack with the fingers below, thumb above. With the disengaged hand strike the pack smartly and at the same moment slightly relax your hold on the pack. It will be found that the entire pack will fall to the floor with the exception of the bottom card which adheres to the fingers.

Piping Automobile Engine Exhaust Gas from Garage

ASPHYXIA caused many deaths in garages before it became generally known that a garage must be well ventilated and the doors left open if the automobile engine is kept running any length of time.

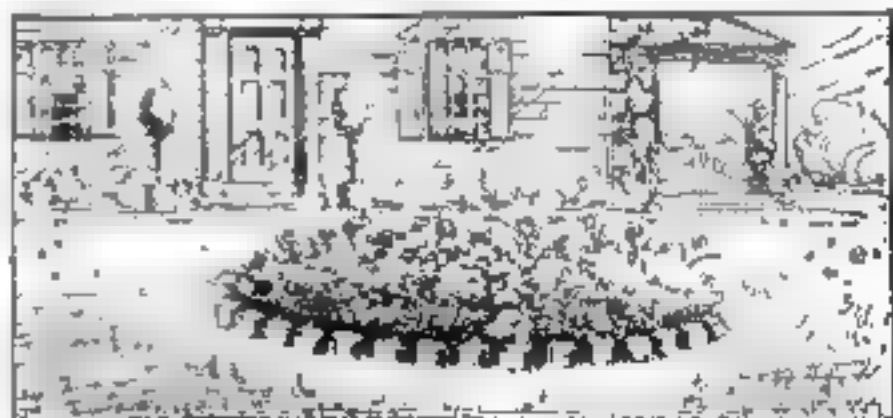


An old drain pipe on a garage floor to remove poisonous gases from the automobile engine

One owner of a private garage avoided the necessity of keeping the doors open by piping the exhaust outside, as shown in the illustration. An old drain pipe was used for the purpose. It was connected in such a way that when the automobile was backed into the garage the end of the exhaust pipe entered the end of the drain pipe. This led down to the floor, where a long piece ran through the wall to the outside and carried all unpleasant or dangerous fumes to the outside, leaving the interior free from the poisonous carbon monoxide gas.—P. P. AVERY.

Edging Flower Beds with Old Bottles

VARIOUS methods are used to construct edging for flower beds that will produce an effect in keeping with surroundings. One simple way is to use a number of



The edging around a flower bed made up of bottles buried part way in the ground

bottles, all the same size, set with their necks in the ground, outlining the shape of the bed. Bottles of different colors may be used, or alternate ones let into the ground deeper, making two levels for the bottoms, which have become the tops, similar to a paling fence.

Flat bottles, shaped on the order of a flask, can be set in zigzag fashion, or like shingles on the siding of a house, to present a very pleasing appearance as a border for a small bed.—LOUIS M. WAHRER.

Repairing a Broken Test Tube or Beaker

WHEN you have broken the top of a test-tube or beaker, do not throw it away, for there is a simple way to cut it off smoothly and make a new lip on it.

Take a three-cornered file and heat the small end that goes into the handle. Now place the red-hot file on a spot below the break, which has been dipped in water, and hold it there until a slight snap is heard. Now lift the file off. You will see a tiny crack $\frac{1}{8}$ in. long. Reheat the file and repeat the operation, following the crack around in a circle. The broken part can be lifted off and a clean-cut rim is the result. To make a flare, rotate the test-tube or beaker over a Bunsen flame until the glass commences to soften, then with a charcoal block, still rotating the tube, press the edges out.

In a similar way a lip can be made by pressing down with one edge of the charcoal block. The hardest part of the work is to get the crack started. Sometimes filing starts it.—MALCOLM MACURDA.

Making and Using a Casting Rod

II.—The manner of making the cast and controlling the line

By Stillman Taylor

BAIT casting with the modern short casting rod is altogether unlike the old method handling the nine foot bait rod. In the new style the casting is done from the reel, and after a little



Fig. 7 The control of the line is entirely regulated by pressure of the thumb on the spool

practice, it is easy to project the minnow or other weight a distance of 75 or 100 ft. Casting is good sport in itself apart from fishing, and by attaching a $\frac{1}{2}$ -oz. weight to the line, practice and contests may be indulged in upon any open lot, or in the public park.

A good smoothly running reel is an important part of the casting outfit, and while the expert tournament casters often pay \$25 or more for their jeweled reels, a very fine reel may be had for about \$5, and serviceable ones as low as \$1.50. The kind of reel to buy is of the long barreled type, having a capacity of about 80 to

likely to be encountered in making fairly accurate casts up to 150 feet. This reel costs about \$1.75.

A good silk line is likewise needed, and while the softer braided silk casting lines are somewhat easier to thumb and less likely to tangle up when you happen to get a backlash, the harder braids soak up less water and will prove most durable. For tournament use, soft braided lines are best; for fishing, pick out the hard braided kind.

As the control of the line is entirely regulated by pressure of the thumb on the

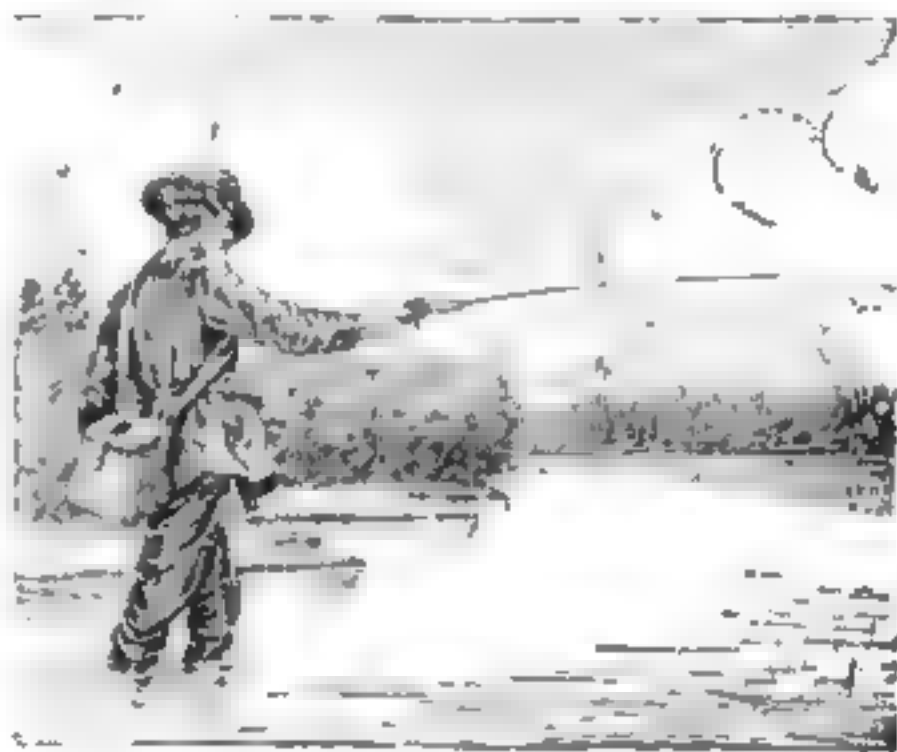


Fig. 9. The rod is brought quickly forward across the body in the direction of the cast

spool, this "thumbing" the line is easiest done when the spool is well filled with line. It is not often necessary to purchase a longer line than 50 yards, and if this amount does not entirely fill the spool of the reel, simply wind on a length of common string to form a core, and wind on the line over it to fill up the spool. Many of the expensive casting reels are fitted with cork or wooden cores or arbors, but the string core will answer all purposes.

Two styles of casting are much used, the underhand and the overhead cast. As the whole secret of casting lies in thumbing the line, the novice should grasp the rod in the correct manner, as shown in Fig. 7.

The underhand cast is the easiest, and



Fig. 8. The underhand cast is started from this position, the tip being about breast high

100 yards of line. A satisfactory reel is shown in Fig. 7, with which no trouble is

is made by reeling in the minnow or plug until it is about 6-in. from the tip. Release the click or drag, press the ball of the thumb firmly on the line on the spool, and swing the rod across the body until it is in the position shown in Fig. 8—the tip being about breast high. Now bring the rod quickly forward across the body

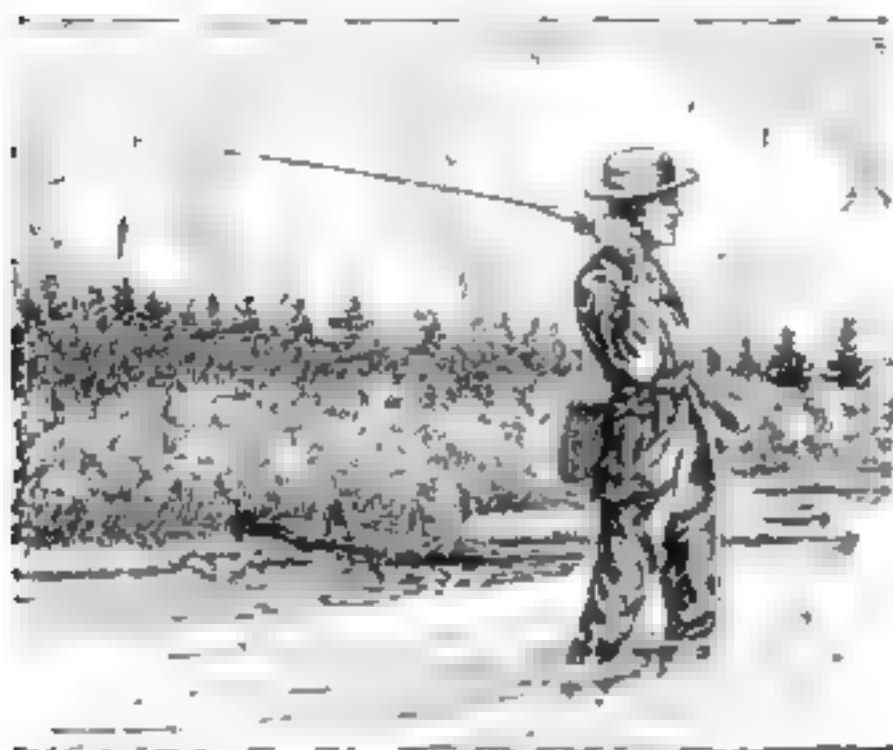


Fig. 10. The overhead cast is generally used by fishermen and tournament casters

in the direction you want to cast, and relax the thumb sufficiently to let the line run out freely, but still keep enough tension on the spool to prevent it from over-running and causing a back lash. The correct underhand cast is completed as shown in Fig. 9.



Fig. 11. The bait is projected in the direction the caster is facing and the finish is as shown

The overhead cast is more largely used by both fishermen and tournament casters; for a greater distance is covered, and after

a little practice a greater degree of accuracy is possible. It is made similar to the underhand cast, but the rod is carried back over the shoulder until it is almost horizontal, as shown in Fig. 10. The arm is now snapped quickly forward and suddenly checked when the rod has reached an angle of about 45 deg., the thumb is partly relaxed, and the bait is projected in the direction the caster is facing. The finish of the overhead cast is shown in Fig. 11.

When reeling in the line for another cast, and when playing a fish, the skillful caster prefers to spool the line evenly on the reel by guiding it between the thumb and finger, as shown in Fig. 12.

When casting for bass, pickerel and other fresh water game fishes, the cast is finished by merely checking the revolving spool as the bait hits the water. The splash of the minnow or other artificial bait, rather attracts than frightens the fish, hence the angler may use any form of bait desired.

The artificial baits now used are of three prominent types; those used on the surface, the diving or underwater baits, and the top-water or weedless lures. The minnow

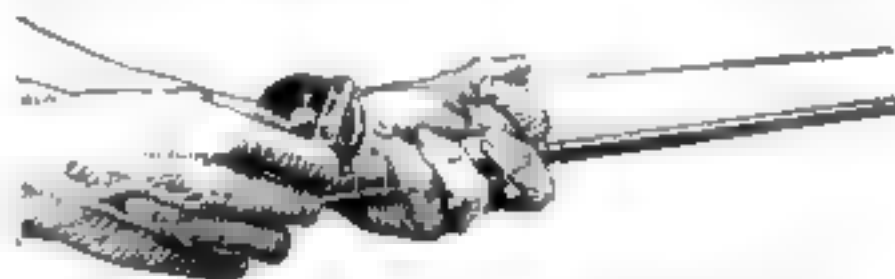


Fig. 12. The line is evenly spooled on the reel by guiding it between the thumb and finger

form, which floats when at rest, but dives when reeled in, is the best for all-around use, equally attractive for pickerel and black bass. However, there are many different forms of varying sizes and colors to choose from, some for general and others for special purposes.

To become a successful angler the caster should know something about the habits of the pickerel or bass in his neighboring waters. In the early days of Spring, when the water is cool, bass are likely to be found in the shallower parts of the stream or lake during the day, and casting should be done around rocks, sand-bars, old stumps, or submerged branches. Pickerel will also be found in the warmer shoal water during this season, and as both species are feeding on minnows and helgramites, the best baits are the common

wooden minnow and the under-water types. For colors, most casters agree that on bright, clear days, and in clear waters, the red and white, red and gray and similar colors, are best. For cloudy days and for casting in muddy waters, the red and green, and yellow colors are good. For sun-down casting, the white or luminous minnows are very attractive.

For summer casting, when the water is warm and weeds and lily pads appear, the bass work out into deeper and cooler water, and the pickerel will be found near the lily pads. The regulation minnow and all the under-water baits are very successful. If the weeds are especially thick, one of the weedless baits may be used, or a weedless or "buck tail" hook substituted for the usual treble hook.

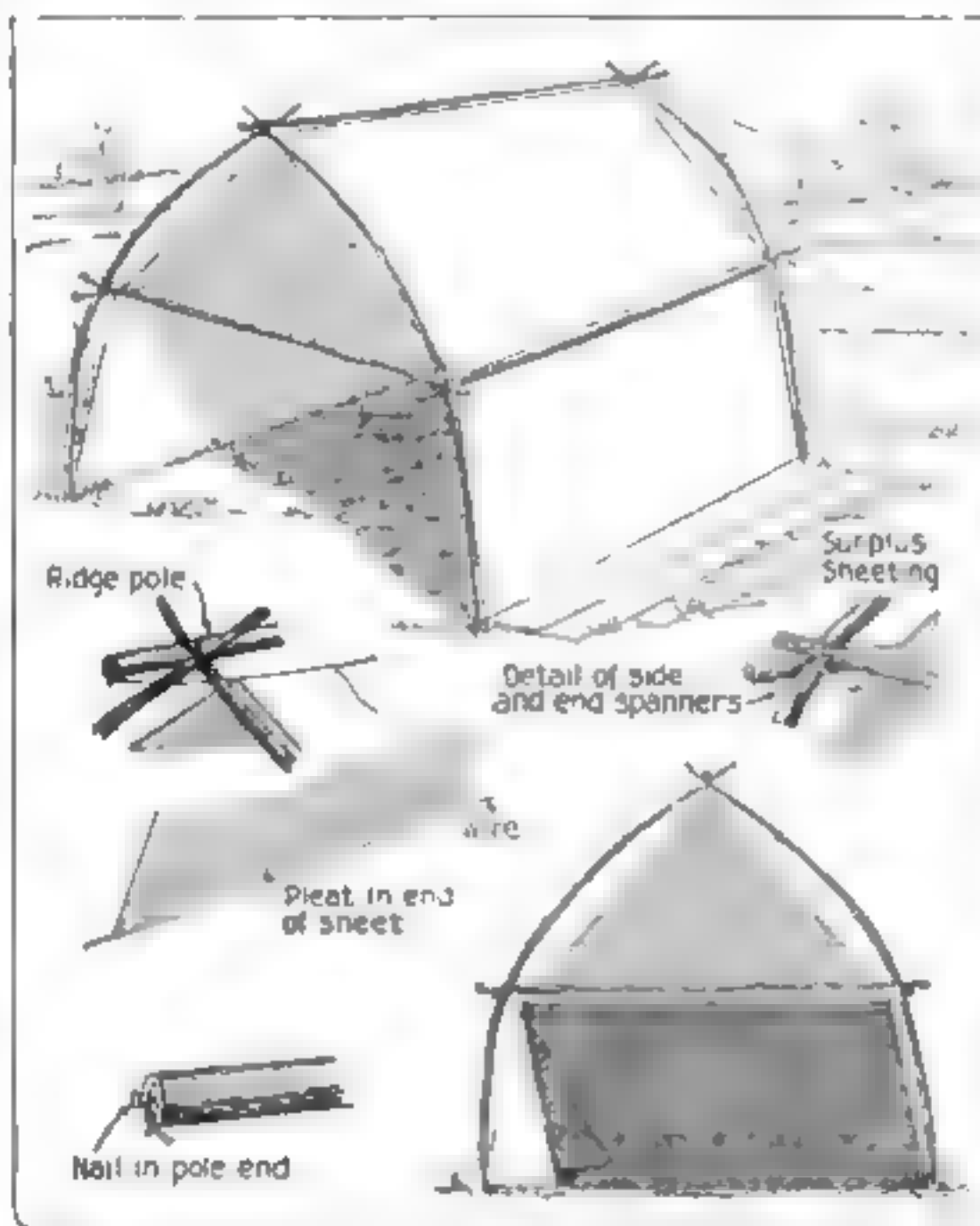
For late afternoon casting—and the early morning and late afternoon hours are the best ones for summer fishing—work around the mouth of any brooks or streams that empty into the lake or pond, and use a diving or under-water bait. Keep the bait always in motion. Do not allow it to remain floating after a cast, but commence to reel in as soon as it strikes the water. As a general thing, beginners reel in too fast, and keep the bait surging along at motor-boat speed. This is a mistake, for no fish can strike at this high speed. If you are out after big fish, reel in slowly, and keep in mind that a well placed cast of 75 ft. is more likely to prove successful than a 100-ft. cast with a backlash at the end of it.

Making a Cabin Tent out of Ordinary Sheeting

A PORTABLE tent, easily carried, quickly erected, adapted for any climatic conditions, and capable of housing four or five persons with comfort may be constructed of a few yards of common sheeting, a small reel of wire, two dozen nails, and a package of safety pins. The

entire outfit will fold up in a roll 2 ft. long, and less than 6 in. in diameter, and weigh less than 7 lb.

Of course regular tent cloth may be used, but in case that should not be available, ordinary sheeting, 90 in. wide, will prove satisfactory. At one end of the sheeting make a wide seam. That is the only sewing required to make it ready for use. The strip should not be less than 7 yd. as this is designed to form the main covering for the



A tent that will house four or five persons is constructed of a few yards of common sheeting and materials from the woods

tent. The poles selected may vary in length, and thus vary the amount of sheeting required.

In addition to this main sheet two triangular-shaped sections of the same goods are provided, the edges of which should be hemmed. To the long side of each triangular piece, tack a strip of netting 4 ft. wide and at least 8 ft. long. The triangular sections and netting form the ends of the tent.

The frame which holds the tent fabric is made of four poles, each 8 ft. long. These should be driven into the ground 6 in. or more, 8 ft. apart, to form the four corners.

In order to make the gables of the cabin the ends of horizontal cross-pieces, or poles, are secured to each pair of uprights, $3\frac{1}{2}$ ft. from the ground. The tops of the saplings are then brought together so as to form two arches, one for each end of the cabin. The horizontal spanners are 7 ft. long.

A ridge pole is then laid on the forks provided by the two arches, and side spanner poles are secured to the arched poles. The intersecting parts of the various saplings are fixed in place by means of suitable wire or twine.

Soft wire is preferable, as it can be quickly applied, twisted and secured by means of pliers. Soft annealed piano wire is the most serviceable. A tinned wire, about 18 gage, is also good for this purpose. We now have the frame ready for the parts necessary to carry the tent cloth; for it is not desirable to stretch the sheet over the wooden frame. We may take a lesson from the umbrella frame which has light ribs to support its covering.

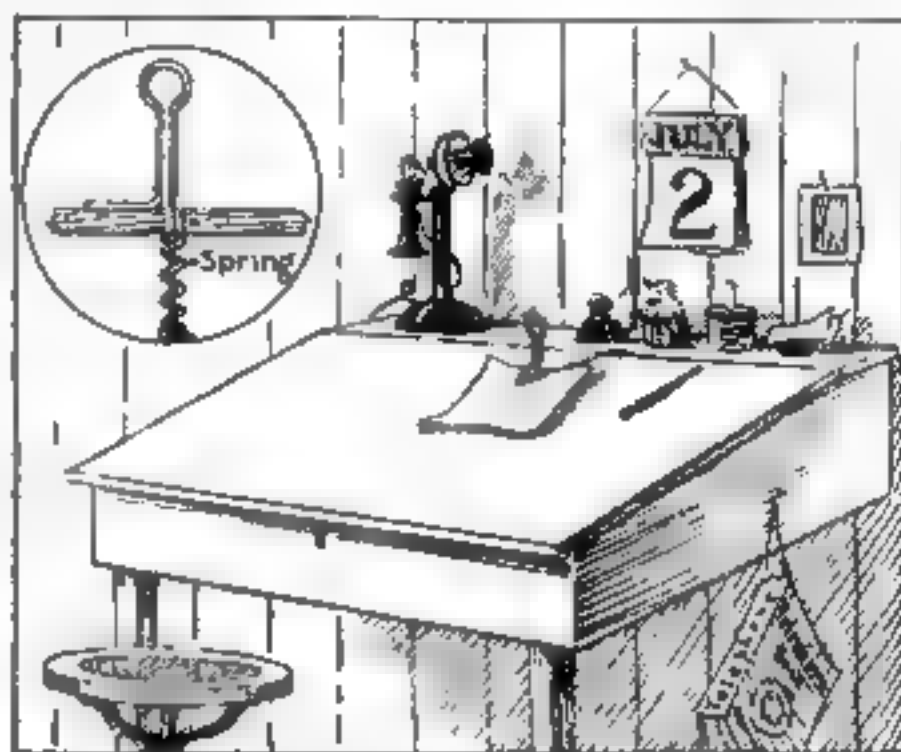
Wires are used to support the sheet of the tent. A few suggestions as to the correct way of attaching these wires may be of great service to the novice. The poles should have their ends cut off square with a small saw. A hatchet might split the wood. Several sets of wires should be prepared beforehand. The end of each wire should have a twisted loop to attach to one end of a pole. Wire nails, $2\frac{1}{2}$ in. long, are best adapted for holding the wires. These should be driven into the ends of the cross and longitudinal poles, or spanners, the loops affixed and the loose ends of the wires attached to the other ends of the respective poles.

The main sheeting is then unrolled and strung over the five taut wires, one end of the sheet being secured to the lower wire, which is threaded through the seam. The other end of the sheet passes behind the other base wire. After stretching the sheet tight the surplus end is secured to the taut portion. The triangular end sections are then attached with safety pins, or buttons or snap-fasteners may be provided for the purpose. It will thus be seen that the entire fabric forming the tent is suspended on wires and does not come into contact with any portion of the wooden frame.

It is not necessary in a cabin tent of this construction that the poles should be driven into the ground. Instead, a wire may be stretched across to connect the lower ends of the front and rear arches.

Holding Papers on a Movable Sloping Desk-Top

IT is difficult to hold letters or other pieces of paper on the surface of an ordinary sloping top desk, even though paper weights are used for the purpose, as the desk-top must be raised at times

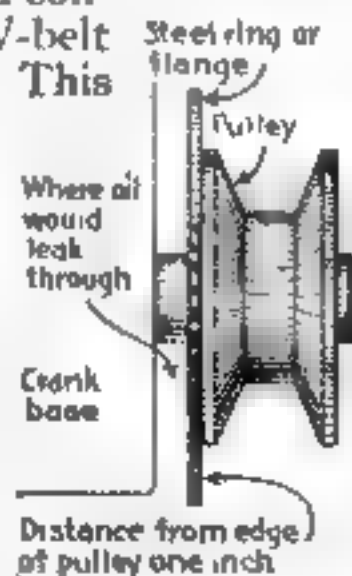


Brass wire clip to hold sheets of paper on a sloping desk top that is raised occasionally

to gain access to the contents within. The illustration shows how a permanent clip or holder can be made of a piece of light brass wire and spring and placed on the desk-top. A small hole sufficient to take the wire size is drilled down through the desk-top. It in no way interferes with the opening and closing of the desk-top.—F. W. BENTLEY.

Keeping Oil from the V-Belt of a Motorcycle

OIL leaking through the shaft bearing and running on the pulley face and entering the groove caused considerable trouble on a V-belt drive of my motorcycle. This difficulty I easily overcame by attaching a steel flange to the inner surface of the pulley, which had a diameter considerably larger than that of the pulley flange. This prevented the oil from getting into the pulley groove by causing it to drip from the flange edge. The flange was out of the way.



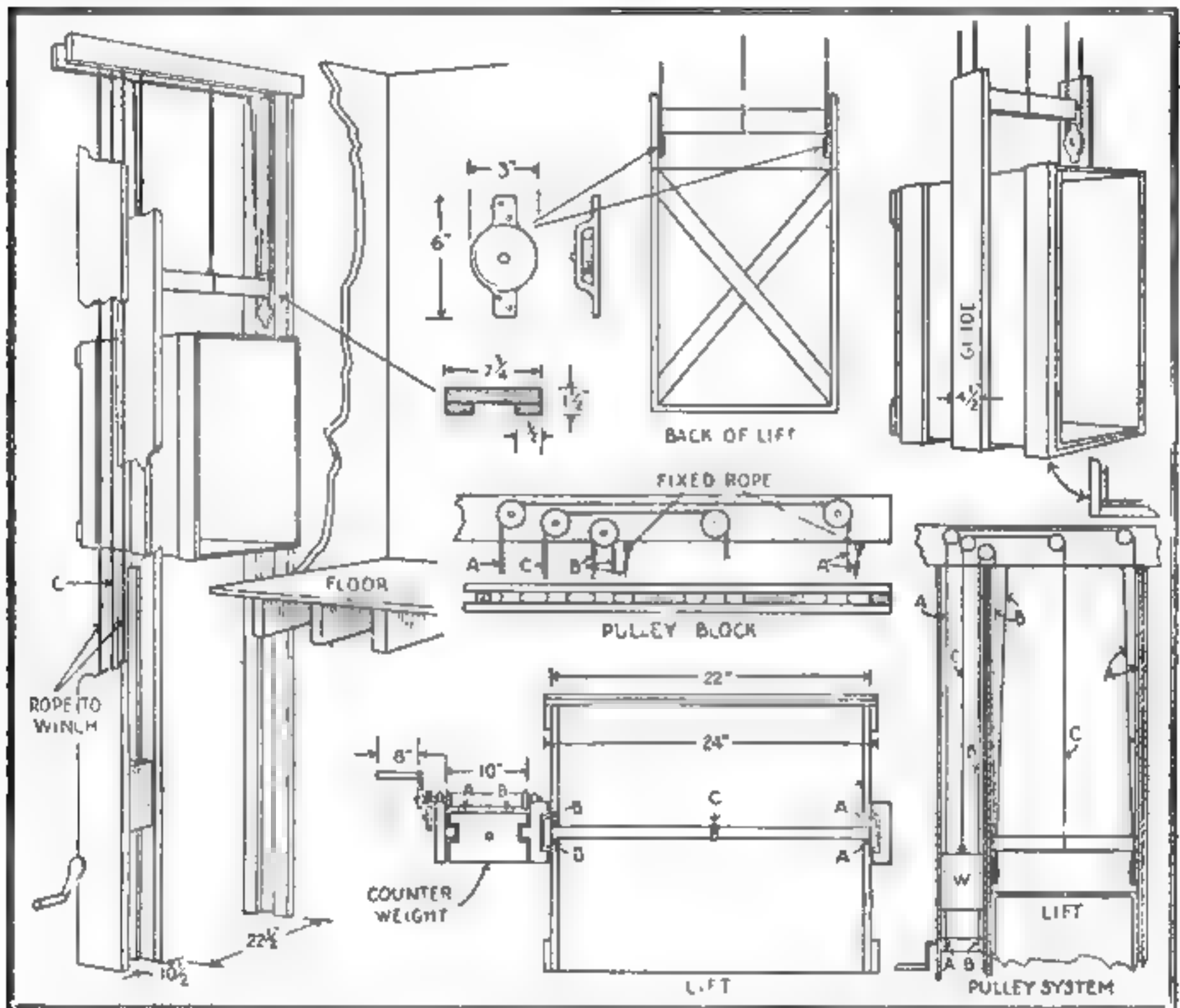
A wide steel flange keeps oil from belt

Cutting Brass Tubing Rapidly on a Buzz Saw

BRASS tubing can be cut off to the required lengths very much faster on a buzz saw than by any other method. A square cut is obtained in this way and by cutting with a set stop, lengths are made exact within a few thousandths of an inch. As compared with cutting off in a lathe or milling machine or by hand the buzz saw

A Labor Saving Wood Lift Built In Like a Dumb-Waiter

A PROPERLY built wood lift is a labor-saving device and may be made inconspicuous by concealing it by means of a paneled door in the wall, as in the illustration. An open-faced box or cage is built and placed in two main braces, to which the pulleys are fastened, serving as guides. It runs between two heavy up-



Parts, guide rails, location of ropes and counterweight for the construction of a wood lift to be built in a house for the saving of labor. It is concealed by a panel in the wall

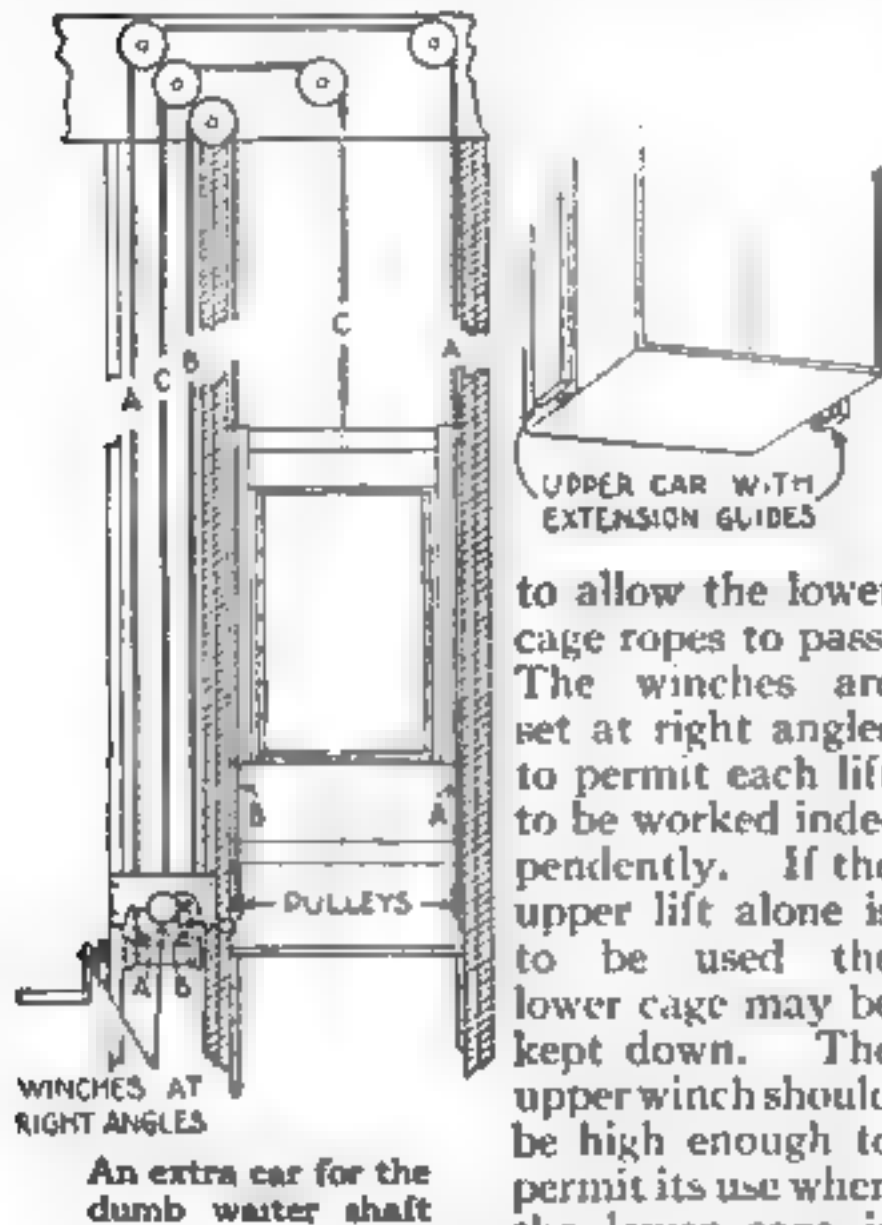
will show a multiplied production. Sheet brass can be cut in the same way in thicknesses up to 1/4 in. The metal heats in the thicker pieces, and gloves must be worn.

A circular saw—not an ordinary wood-cutting saw—is used for cutting metal. These saws have a different temper from wood saws, have finer and different shaped teeth and have very little set. The tubes are held and the work is done just as if they were wood pieces.

rights equipped with guide-rails. A third upright makes a "well" for ropes and a counterweight. Two lengths of 3/16-in. rope, *A* and *B*, with ends fixed in an overhead pulley-block, run to cage pulleys and back to sheaves fixed in the overhead block, and thence to the winch, as shown. A third length *C* connects the car with the counterweight.

A lift built to an upper floor, with doors in the first and second floor walls, is almost

useless unless two cars are placed in the shaft. A two-car system is ideal where the lift is carried to an upper floor with openings on both floors. The upper box has guides of a special design, as shown,



to allow the lower cage ropes to pass. The winches are set at right angles to permit each lift to be worked independently. If the upper lift alone is to be used the lower cage may be kept down. The upper winch should be high enough to permit its use when the lower cage is

down, as the accompanying drawing shows. Frequently, because of small capacity, difficulty of operation and inaccessibility, it is as easy to carry firewood upstairs in the old-fashioned way. But this lift has a large capacity and its open side not only offers its contents readily, but provides a means of cleaning. While it is often possible to build a lift beneath a stairway, convenience should not be sacrificed to save a few feet of floor or bookcase space. There should be some way of reaching the pulley-block at the top of the shaft to oil the pulleys.—EDWARD R. SMITH.

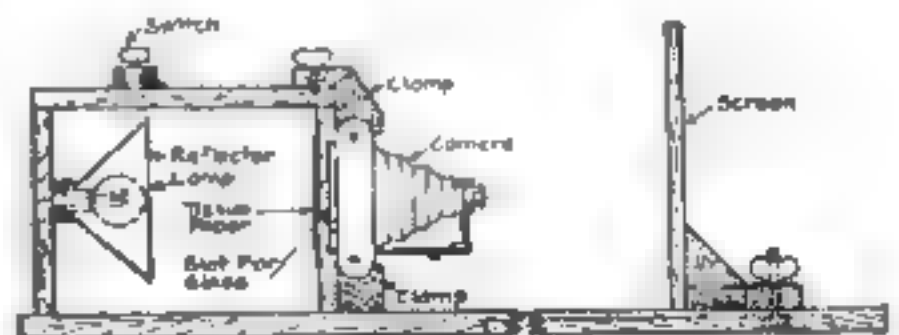
Improving Your Piano by Moistening the Air in the Room

A RELIABLE piano tuner says that pianos are often injured because they become too dry. Keep a growing plant in the room with the piano and see how much more water it will require than the plants in any other room. A large vase with a wet sponge kept near the piano will supply moisture.—C. A. WOLFE.

A Simple Camera Attachment for Photographic Enlarging

ANYONE owning an ordinary folding pocket camera with adjustable focus can easily make and use this enlarging outfit. The sketch shows a longitudinal section and gives an idea of the general arrangement. The box is fitted up with an electric lamp, socket and reflector. The other end has a square hole the size of the opening in the rear of the camera cut into it. Two clamp pieces are cut out and fastened to the box as shown, so that the camera is held firmly to the opening in the front of the box. A slot is recessed over the hole so that a sheet of orange-colored glass will slide in it and cover the square hole. The base-piece is extended several feet beyond the camera and is slotted its entire length. A sliding screen of some lightweight material is made and fastened in the slot in the base with a thumb-screw, as shown. A sheet of fine white tracing paper should be fastened over the inside of the hole in the box so as to diffuse the light from the reflector and prevent unevenness of light distribution.

Place the film or plate in the opening in the back of the camera and turn on the light. Have the sheet of orange glass in the groove provided for it back of the camera. Darken the room and pin a sheet of bromide or other enlarging paper on the sliding screen with thumbtacks. The orange light coming through the lens will furnish sufficient illumination for this. Now focus the image on the paper by moving the camera bellows in or out and by moving the screen to and from the



Enlarging pictures with an ordinary camera placed on a box inclosing an electric light

camera until the correct focus is obtained. Now slide out the orange glass and expose the paper for the required time, after which replace the glass to stop exposure. Develop the paper in a red or orange light only. A sixteen candlepower mazda light will operate the apparatus.—B. FRANCIS DASHIELL.

A Teeter Swing for Public or Private Playground

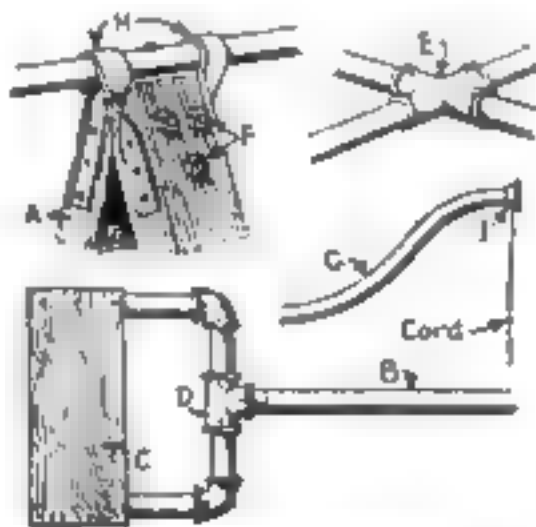
THE illustration shows a way to make a permanent amusement device for children's playgrounds. It is inexpensive to build and if erected will prove as attractive to children as many other more elaborate devices.

Two planks *A* 16 ft. long, 10 in. wide and 2 in. thick form the support for the teeter *B*, which is made of two pipes, each $1\frac{1}{2}$ in. in diameter and 9 ft. long. The seats *C* consist of a board strapped on the pipe arrangement *D* which provides an opening for the legs, making it almost impossible for a child to fall out of the seat. The support for the main pipes is shown at *E*, each end of which passes through the planks with a coupling on the ends to prevent the piece dropping out of the holes bored in the planks.

The plank ends are sunk into the ground at one end and fastened together with a bolt *F*. The piece *G* is made from $1\frac{1}{4}$ -in. pipe strapped to the planks at *H*. Window cord is attached at the ends *I*. Two children, even of very unequal weight, can have an enjoyable time on this swing, as the teeter is worked by pulling on the cords rather than by balancing weight. The riders can use their feet to help the movement. If required, a brake can be easily added to prevent the seats striking the ground.—JAMES E. NOBLE.



A playground teeter made of pipe and fittings for the swinging part and planks set in the ground for the supports



Details of the parts for making a teeter swing

An Interesting Experiment with Sulphate of Soda

AN experiment of an unusual character may be made with a thoroughly sterilized glass rod and a supersaturated solution of sulphate of soda. The phenomenon is so extraordinary that any one who may make the trial will find it difficult to clearly explain the result. To make it more interesting four glass tumblers should be used. Place them in a saucepan of cold water with their bottoms resting on cardboard, then bring the water to a boil. Meantime dissolve some sulphate of soda in another vessel, by pouring the soda sulphate into boiling water until the water will take on no more. Now remove the tumblers and place them upon a board. Fill them with the saturated solution and stand them aside to cool in a place free from vibration. If this part of the work is done at night the solution will be quite cold in the morning and ready for the test. Do not disturb the contents of the tumblers, or crystallization will set in at once and spoil the experiment.

Take an ordinary round glass stirring-rod that is about 1 ft. long and $\frac{5}{16}$ in. in diameter and clean it well; then in the flame of an alcohol or other burner heat about 3 in. on one end of the rod almost red hot and place it to cool in such a position that the heated end will not touch anything. As soon as cold, take the rod and dip the end that was heated into one of the tumblers containing the solution. No action whatever will take place; but as soon as the other end is inserted, the salt will immediately start to crystallize and will rapidly continue to do so until the solution becomes a solid mass.

If each tumbler is stirred at the start with the sterilized end of the rod, the same performance will take place.

Drying Fruits and Vegetables

A simple method of drying your surplus supply of fruits and vegetables for future use

THE advantages of drying vegetables are not so apparent for the farm home as they are for the town and city household, which has no root cellar or other place in which to store fresh vegetables. For the farmer's wife the new methods of canning probably will be better than sun drying, which requires a somewhat longer time. But quicker methods of drying are now in use, and the dried product holds an advantage in that it usually requires fewer jars, cans or other containers than do canned fruits or vegetables; also dried material can be stored in receptacles which cannot be used for canning. Then, too, canned fruit and vegetables freeze and cannot be shipped in absolute safety conveniently in winter.

With a simple and inexpensive equipment all housewives can save quantities of food which are too small conveniently to can. A few sweet potatoes or apples or peas or even a single turnip can be dried and saved. Even when very small quantities are dried at a time, a quantity sufficient for a meal will soon be secured. Small mixed lots of

dried vegetables, such as cabbage, carrots, turnips, potatoes, and onions, can be packed together and used for soups and stews.

Three principal ways are applicable for the home preparation of dried fruits and vegetables; namely, sun drying, drying by artificial heat, and drying by air blast. These, of course, may be combined. In general, most fruits or vegetables, to be dried quickly, must be shredded or cut into slices, because many are too large to dry quickly or are covered with a skin, the pur-

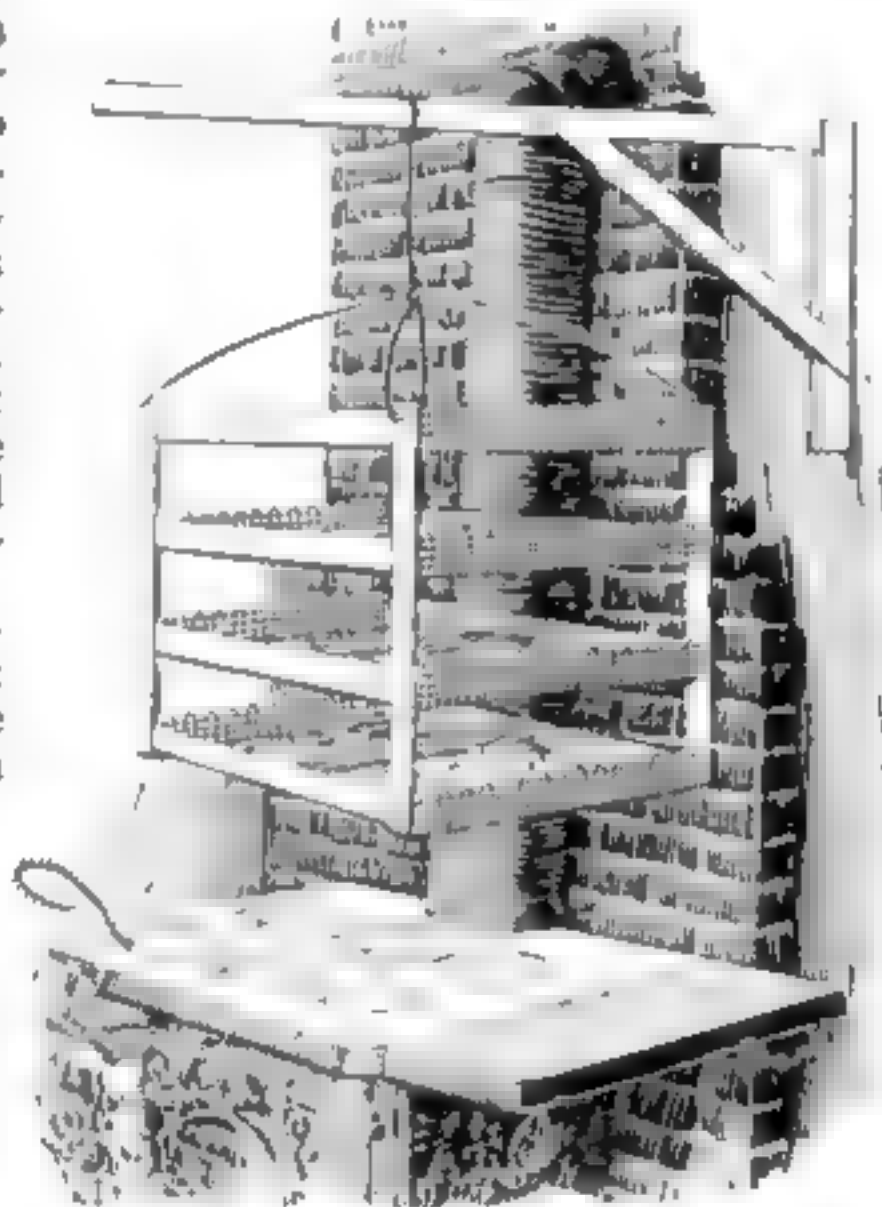
pose of which is to prevent drying out. When freshly cut fruits or vegetables are to be dried by means of artificial heat, they should be exposed first to gentle heat and later to the higher temperatures. If the air applied at the outset is of too high a temperature, the cut surfaces of the sliced fruits or vegetables become hard, or scorched, covering the juicy interior so that it will not dry out. Generally it is

not desirable that the air temperature in drying should go above 140 deg. or 150 deg. F., and it is better to keep it well below this point. Insects and insect eggs are killed by exposure to heat of this temperature.

It is important to know the degree of heat in the dryer, and this cannot be determined very accurately except by using a thermometer. Inexpensive oven thermometers can be found on the market, or an ordinary chemical thermometer can be suspended in the dryer. If a thermometer is not used, the greatest care should be given to the regulation of heat. The temperature in the

dryer rises rather quickly and the product may scorch unless close attention is given. The reason sun drying is popularly believed to give fruits and vegetables a sweeter flavor is probably because in the sun they are never scorched, whereas in the oven or over a stove, scorching is a common occurrence.

A cheap and very satisfactory dryer for use over the kitchen stove is one that was worked out by the Department of Agriculture at Washington. Any handy boy or



A frame made of laths or strips of wood to hold trays of galvanised wire mesh and swung over the range with a crane

carpenter can make one from a small quantity of fine mesh galvanized wire netting and a number of laths and strips of wood about $\frac{1}{2}$ in. thick and 2 in. wide. The screen may be tacked directly on the framework to make the drying shelves, or the framework can be made to support separate trays. By using two laths nailed together the framework can be stiffened and larger trays made if desirable. This form or any of the lighter makes of dryers can be suspended from the ceiling over the kitchen range or over the oil or gas stove, and it will utilize the hot air which rises during the cooking hour. It can be raised out of the way or swung to one side by a crane made of lath when the stove is required for cooking purposes, and lowered or swung back to utilize the heat which otherwise would be wasted when the top of the stove is not in use.

Another home-made cookstove dryer that can be used on a wood or coal range or a kerosene stove can be made easily and cheaply as shown in the second illustration. The dimensions of the base are 24 by 16 in., the height being 36 in. A base 6 in. high is made of galvanized sheet iron. The base slightly flares toward the bottom and has two small openings for ventilation in each of the four sides. On the base rests a box-like frame made of 1 or $1\frac{1}{2}$ -in. strips of wood. The two sides are braced with $1\frac{1}{4}$ -in. strips which serve as cleats on which the trays in the dryer rest. These are placed at intervals of 3 in. The frame is covered with tin or galvanized iron which is tacked to the wood strips of the frame. Thin strips of wood may be used instead of tin or sheet iron. The door is fitted on small hinges and fastened with a thumb latch. It opens wide so that the trays can be removed easily. The bottom of the dryer is made of a piece of perforated galvanized

sheet iron. About 2 in. above the bottom is placed a solid sheet of galvanized iron which is 3 in. less in length and width than the bottom. This sheet rests on two wires fastened to the sides of the dryer. This prevents the direct heat from coming in contact with the product and serves as a radiator to spread the heat more evenly.

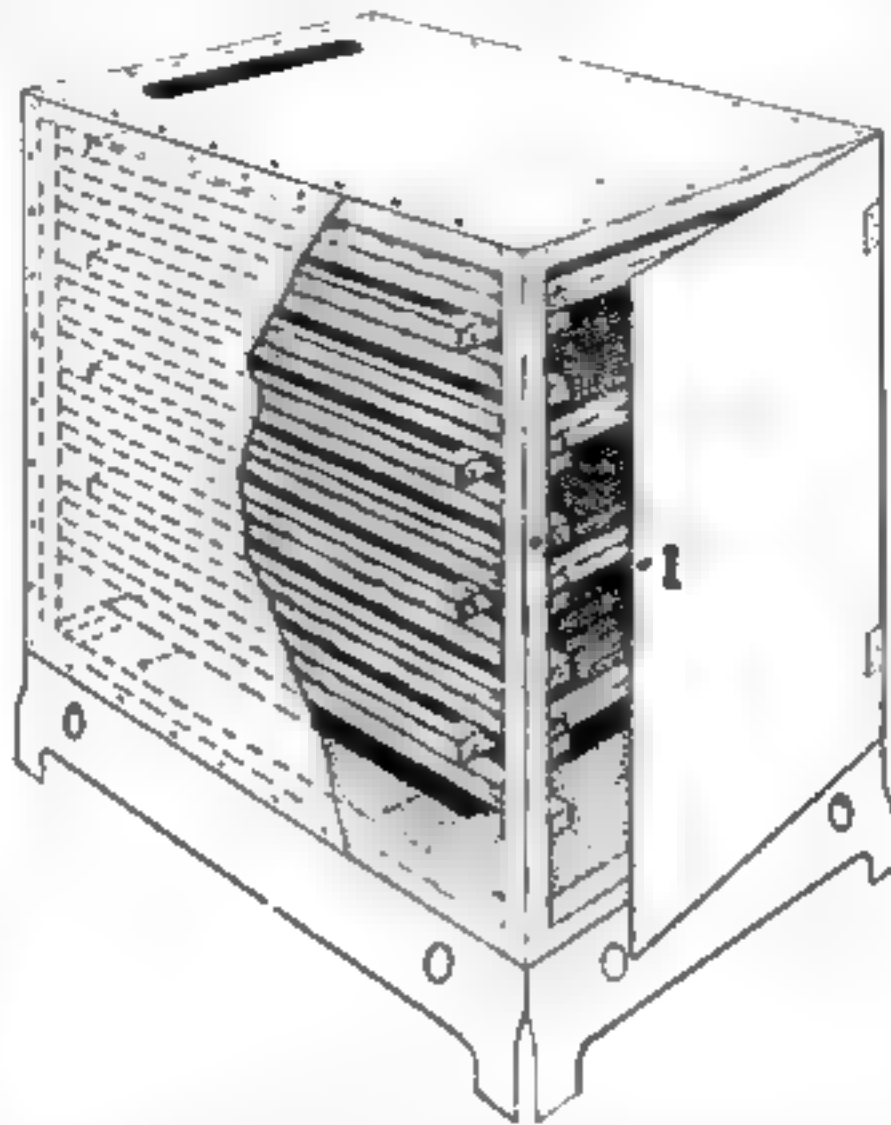
The first tray is placed 3 in. above the radiator. The trays rest on the cleats 3 in. apart. A dryer of the given dimensions will

hold 8 trays. The frame of the tray is made of 1-in. strips on which is tacked galvanized screen wire, which forms the bottom of the tray. The tray is 21 by 15 in., making it 3 in. less in depth than the dryer. The lowest tray when placed in the dryer is pushed back, leaving the 3-in. space in front. The next tray is placed even with the front, leaving a 3-in. space in the back. The other trays alternate in the same way. This permits the current of heated air to pass around and over the trays. A ventilator opening, about 2 in. wide and 6 in. long,

is left in the top of the dryer, through which the moist air may pass away.

This principle of construction is followed so that currents of heated air will pass over the product as well as up through it, gathering the moisture and passing away. The movement of the current of air induces a more rapid and uniform drying. The upper trays can be shifted to the lower part of the dryer, and the lower trays to the upper part as drying proceeds.

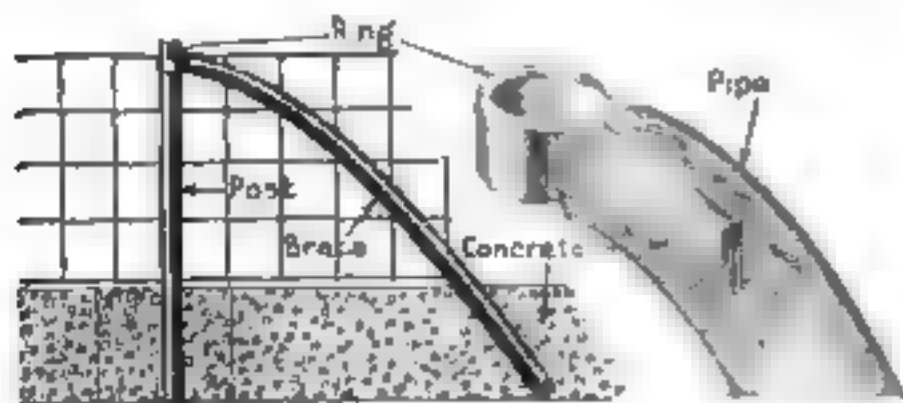
If fruits or vegetables are packed in tight containers immediately upon being dried thoroughly, they will remain just as brittle as they were when taken from the dryer. If, however, they are not dried thoroughly, they will "sweat" and soon mold. To prevent this the material should be examined within 24 hours after packing, and if it appears moist, dried further.



A cookstove dryer that has a metal base for setting on top of a wood or coal range

A Bracing for an Iron Pipe Fence Post

THE illustration shows how a fence, the posts of which were ordinary iron pipe, was braced with a bent piece of the same sized pipe so as to stand a severe



A curved post brace set in concrete to make a solid support for stretching wire tightly

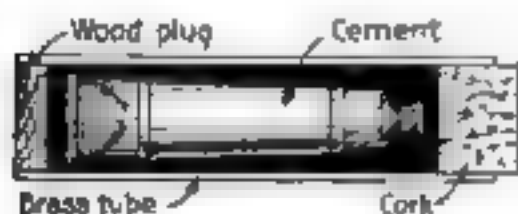
pull when the wire fencing was stretched on it. The brace and the posts were filled with cement, and the ring was inserted in it. The ring was shaped from a piece of heavy, flat wrought iron, which had enough shank to fit solidly into the pipe. The bases for the posts were built first and the remainder of the concrete work was left until later on, so that should any cracks develop along the edge of the post base they could be easily located and remedied.—JAMES M. KANE.

Attaching Linoleum to a Cement Floor

A GOOD cement for attaching linoleum to a cement floor may be made as follows: Manila gum 15 parts, brown rosin 20 parts and thick turpentine 45 parts, all by weight. Pulverize the rosin and gum and heat until melted; then thin out with denatured alcohol, using 20 parts.

Casing for Carrying Tube Cements Without Damage

HAVING trouble keeping the rubber cement tubes in the tool bag of my bicycle clean, I devised the tube-carrying case shown in the illustration. It consists of a brass tube about 1 in. longer than the cement tube and a little larger in diameter, with one end plugged and the other corked.—AXEL H. JOHNSON.



A Silver-Plating Bath and How to Use It

THE most important attribute for the amateur plater to cultivate is caution. He is working with some of the most deadly poisons known to chemistry. He should not inhale the fumes given off in mixing solutions and should not get these solutions on his hands or clothing. No vessel employed in plating should be used for any other purpose.

The electric current for plating should be supplied by some form of steady current battery, giving low voltage and high amperage, such as the Edison primary, Bunsen, or Fuller cells. The cells of the battery should be connected in parallel. The current must not be above two volts. For the anode, purchase a sheet of pure silver from a jewelry supply house. The sheet surface should contain from 1 to 4 sq. in. Such a plate 1/32 in. thick will cost from 75 to 90 cents. The position of the anode should be adjustable; so that more or less of its surface can be immersed, and so that it may be moved toward or away from the article being plated.

A pair of heavy wires should be provided, long enough to reach across the top of the plating tank. When placed in position the wire carrying the anode is connected with the carbon of the battery, and the one carrying the article to be plated is connected with the zinc. Cut several lengths of No. 14 or No. 16 copper wire; bend into a hook at the top, to hang on the rod connected with the zinc, and long enough to reach to the bottom of the tank. These are called "slinging wires," being twisted around the work suspended in the solution.

The next operation is to mix the solutions. Only pure chemicals should be used. Graduates, mixing vessels, evaporating dishes, mixing rods, etc., must be chemically clean. Use glass rods or tubing for stirring rods.

The nitrate of silver bath is made by dissolving pure scrap silver in a 25 per cent nitric acid solution. After the solution has been evaporated, the resultant crystals are dissolved in two quarts of distilled water. In another vessel, mix 1 oz. of potassium cyanide crystals in water, and add this slowly to the silver nitrate solution. Enough of the two solutions have been mixed when a precipitate forms. The liquid should be poured carefully from the material in the bottom, which is silver cyanide. This precipitate should be thoroughly washed in pure cold water.

Make up another solution of 1 oz. of the cyanide salts in a quart of pure water and pour enough of this over the washed precipitate to dissolve it, stirring well. When a clear, colorless liquid results, add more of the cyanide solution as there must be a slight excess of cyanide in the plating bath. Add enough water to give the desired quantity or strength.

If pure silver nitrate can be obtained, it may be used instead of the metal solution. Pure nitrate will contain approximately 635 grains of the metal in each 1000 grains of the salt.

A very good solution for ordinary work can be made by dissolving 1 oz. of pure silver nitrate in 40 oz. of water and proceeding as above to throw down and wash the precipitate and redissolve it in the cyanides. By adding two quarts of water, it is ready for use.

Preparing the Article to Be Plated

Having prepared the apparatus and solutions, the preparation of the work to be plated is next in order. Plating will cover no defects, such as stains, scratches, etc., but is likely to make them more prominent. Every blemish should be removed with a file or emery paper and the surface polished.

To remove corrosion from brass, copper, etc., soak the article in a solution made by adding—a little at a time with free stirring—3 oz. of sulphuric acid to 4 oz. of water, and when this has cooled, pour in $1\frac{3}{4}$ oz. of nitric acid. Be sure to add the sulphuric acid to the water a little at a time, allowing it to mix and cool before adding more, finally adding the nitric acid. Soak the work to be cleaned in this solution until all the corrosion is dissolved, or softened so that it may be removed with a stiff brush; then rinse thoroughly and polish. The time required to remove corrosion will vary from a few seconds to an hour or more.

Those parts which are to have a polished appearance when finished must be well polished before they are plated. This may be done in any way convenient. To use a polishing lathe or stand is the best method. Cloth disks, from 3 in. to 6 in. in diameter and $\frac{1}{2}$ in. to 1 in. thick may be made, some of canvas or other heavy, hard cloth, and others of flannel or muslin for the finishing touches. They should be used with powdered abrasives, using emery for the rougher operations and finishing with fine polishing powders and soft disks. If a

lathe is not at hand, use brushes, and cloths.

When the work has been polished it should be washed thoroughly so that no traces of the polishing materials remain. After polishing and washing, the articles should be attached to the slinging wires so that they need not be touched by the hands again. Soak the work a few moments in a hot solution made of a tablespoonful of potash in a pint of water. This is the potash "dip" and is to remove all traces of grease and dirt that may have been left.

After being given the potash dip the work is laid on a board where a small stream of water may flow over it while it is brushed with a stiff bristle brush, kept wet and occasionally dipped into powdered pumice stone. This will remove all the potash and grease and also give a slight grain to the surface of the plated article.

After scouring, rinse the work well in running water and soak for a few seconds in a solution made by dissolving an ounce of potassium cyanide in a pint of water and hang at once in the plating bath. Have the anode in position and the battery connected before hanging the work; otherwise the cyanide in the bath will attack the metal and injure the bath. The article will become white in a moment and a plate of silver will be deposited in from ten to fifteen minutes.

The Finishing Touches

When plated heavily enough, the article should be taken from the bath, rinsed in boiling water and dropped into fine, warm sawdust to dry. Exposure of a freshly plated surface to the air and light while it is covered with a film of the plating solution, will cause it to turn yellow. When dried in the sawdust, it should be brushed and will appear a frosty white.

The first finishing is scratch brushing. A small brush wheel of fine brass wire is held in a lathe or polishing stand, and kept wet with stale beer or oatmeal water. The plated surface is held against it. Without a machine a bristle brush may be used, if stiff enough. When all the chalky whiteness has disappeared and the metal shows an even, dull color, give it another rinsing in plenty of water and dry. It is now ready for buffing and polishing with soft materials, light pressure and fine polishing powders.

If an extra heavy and durable plate

is desired, it is best to proceed as follows: Apply a first plate and finish it. Then go over the operation again, dipping in the hot potash solution, rinsing, scouring, dipping again in the cyanide solution and replacing in the plating bath and then finishing and polishing a second time. This will give better results than if a very heavy plate were put on in one operation.

Articles of different metals or alloy, will not plate at the same time. This will be noticed if there is a soldered joint in the work. Such joints must receive treatment so the solder of the joint will take the plate as well as the rest of the surface. To plate on a soldered joint, make an ounce or two of saturated solution of sulphate of copper and distilled water. Add one-tenth of its volume of sulphuric acid. After the work has received the final scouring and rinsing, and before dipping in the cyanide bath, take a piece of small, clean, iron wire, or a small brush made of iron wire, and dip it in the sulphate solution and draw along the joint. A film of copper will cover the solder instantaneously and to this the silver will readily adhere.

If the current is too heavy, the silver film deposited will lie loosely, with a hard dark appearance, and such a plate will not polish. This condition may be remedied by moving the articles farther from the anode and by raising the anode so that less of its surface is in the bath. Too high voltage with too little amperage will also cause a deposit of this kind. Articles being plated should be kept in gentle motion or moved frequently, as the solution has a tendency to settle, resulting in uneven plating.

Too much cyanide in the plating bath will cause the anode plate to assume a white frosted appearance with rough edges. A deposit from such a bath cannot be polished readily. Too little cyanide will cause the anode plate to be covered with a dark deposit having a hard, close-grained appearance, and the plating will be dirty and uneven. When either condition appears, it should be remedied by the addition of a small amount of silver solution, or of the cyanide solution, whichever is necessary. When a bath works properly and the anode remains clean and bright, the only material to be added is a little distilled water occasionally, to counteract evaporation. A plating bath will remain fresh for a long time if the evaporation is taken care of,

and the vessel protected from dust and strong light.

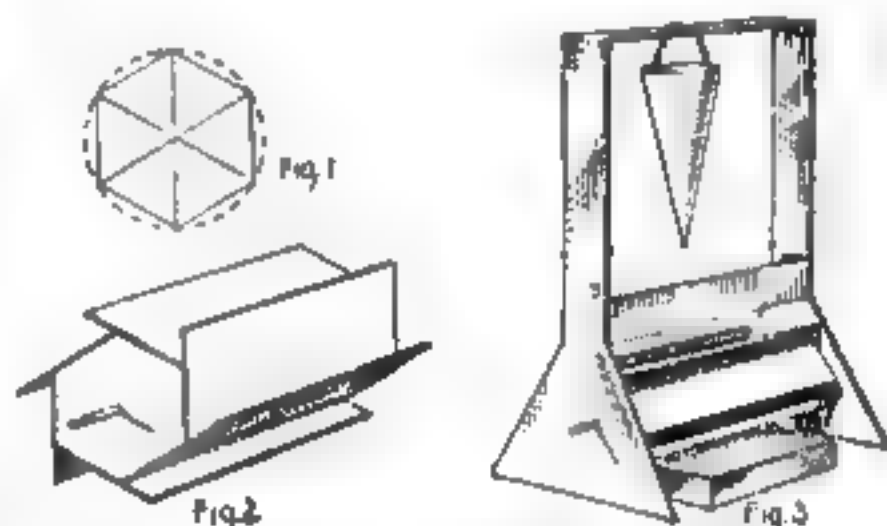
All operations connected with the actual depositing of the plate and the first finishing should be conducted in dim light. A strong bright light will have a harmful effect on both the plating solution and the freshly deposited silver.

A Simple Toy Motor Run with Dry Sand

THE only materials needed in the construction of this sand motor are 2 needles, 1 cork stopper, some cardboard and heavy paper, glue and a quantity of fine sand.

The stopper should be a very large size. On both ends of the cork mark off with a pencil a 6-sided polygon. With a sharp knife cut the cork as shown in Fig. 1.

Cut six pieces of cardboard for the blades of the sandwheel and glue them to the cork as shown in Fig. 2. Push a needle, eye first, into each end of the cork, as shown.



The sand falling from the cone drops on the edge of the uppermost blade of the wheel

The framework of the motor shown in Fig. 3 is made from three pieces of cardboard glued together. The sand wheel is mounted at the bottom of the frame by pushing the needles through the cardboard. From the top of the frame a paper horn, filled with sand, is suspended by a short piece of thread. The sand sifts down over the blades of the wheel through a hole in the end of the horn. A small cardboard box should be placed under the wheel to catch the sand as it drops from the blades. A small grooved pulley wheel may be attached to one needle end and used with a thread for a belt to turn a light toy machine. The wheel can be fastened with a bit of wax. The sharp ends of the needles should be broken off.—E. P. THORNTON.

Wigwam Made of a Tripod

By H.J. Blackwell

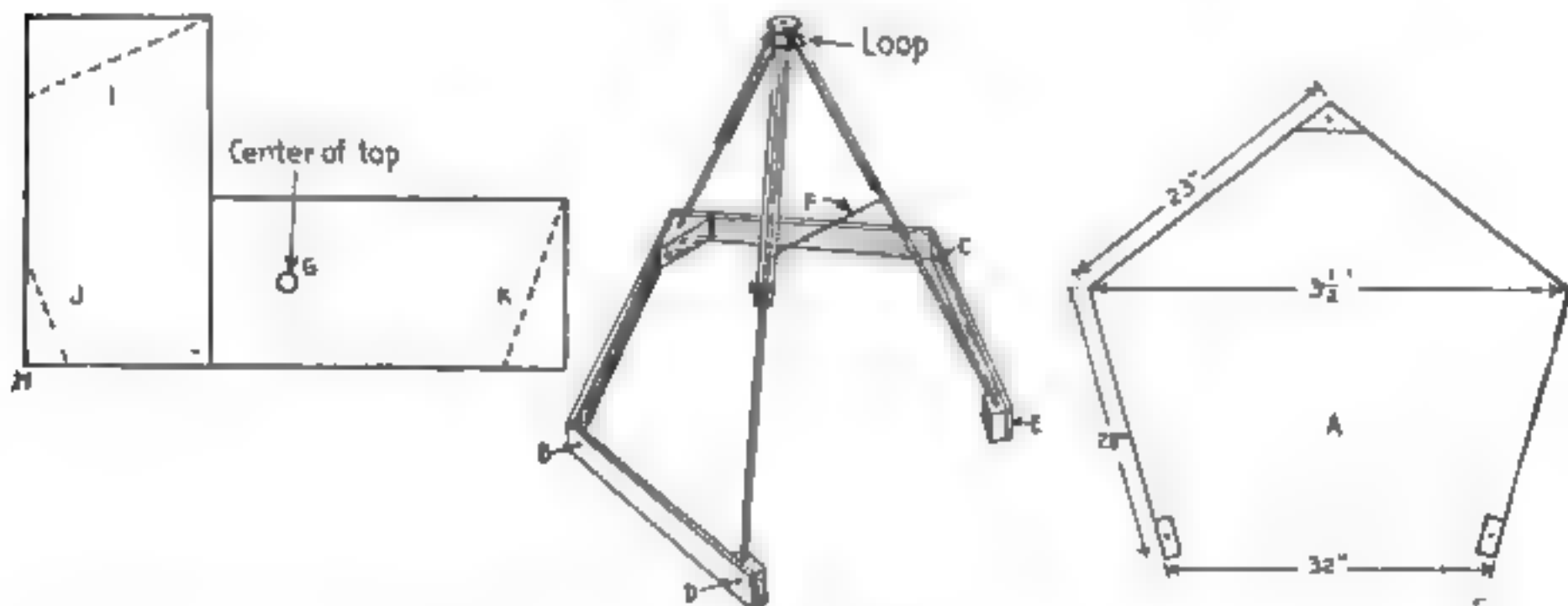


FOR the person always carrying a camera in the woods in search of pictures the wigwam illustrated will be of considerable interest, as the tripod of the camera equipment is used for the support. The other necessary parts are four pieces of 2-in. material $\frac{3}{4}$ in. thick, two 23 in. long and two 28 in. long, three small blocks, three hinges, two pieces of $\frac{1}{4}$ -in. rope, each 9 ft. long and 4 yards of cloth 34 in. wide. The four pieces are fastened together as shown at *A*, placing the hinges on the ends of the joining parts. One of the blocks is cut like a triangle and fastened at the back to one piece as shown. The other two blocks are cut rectangular and nailed to the inside surfaces on the ends of the pieces not joined with a hinge. Holes are bored in these blocks about $\frac{1}{2}$ in. deep to admit the ends of the tripod legs. Holes $\frac{1}{4}$ in. in diameter are bored through the pieces as at *B*, *C*, *D* and *E*.

A loop about 5 in. in diameter is made of a scrap of cord or rope and placed over the top of the tripod after the feet are set in the holes bored in the blocks. Tie a knot in one end of one rope and run the opposite end through the hole *B*, up over the loop, down and through the hole *C*; draw up snugly and tie the end. Run the other rope through the holes *D*, *E* and the loop in the same manner, and tie knots in the ends.

A stick with a notch in each end and about 16 in. long is placed in the tripod at *F* before the last rope is drawn in place. When this is complete the frame may be picked up and carried without fear of its falling apart.

The cover may be of burlap, canvas, duck, denim or muslin. It is made of two pieces, each 2 yards long. Sew them together as shown in the illustration.

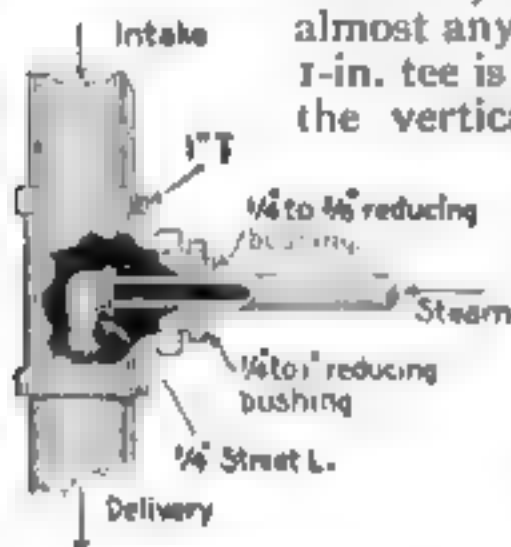


The two pieces of cloth are sewed together in an L-shape, then wrapped around the tripod legs, and tied down to form the wigwam top, with a front opening at the point where there is no base

This is placed over the tripod top, locating place *G* on the screw-plate of the tripod. The corner of the cloth *H* is fastened at *D*; then the cover is carried around the frame, folding where necessary. It is then trimmed on the lines *I*, *J* and *K*. The trimming should not be done until it is in position on the frame and pinned. After shaping it in this manner the pins will hold it so that the cover may be removed for sewing. When complete it can be dropped over the frame and fastened to the base pieces with thumb tacks.

A Siphon Made Out of Gas Pipe and Fittings

A SIPHON is very frequently needed for many purposes about a manufacturing plant. The illustration shows how a very practical siphon can be constructed from pipe fittings, and which will work very satisfactorily under almost any circumstances. A 1-in. tee is used for the body, the vertical openings being



A siphon made of pipe and fittings

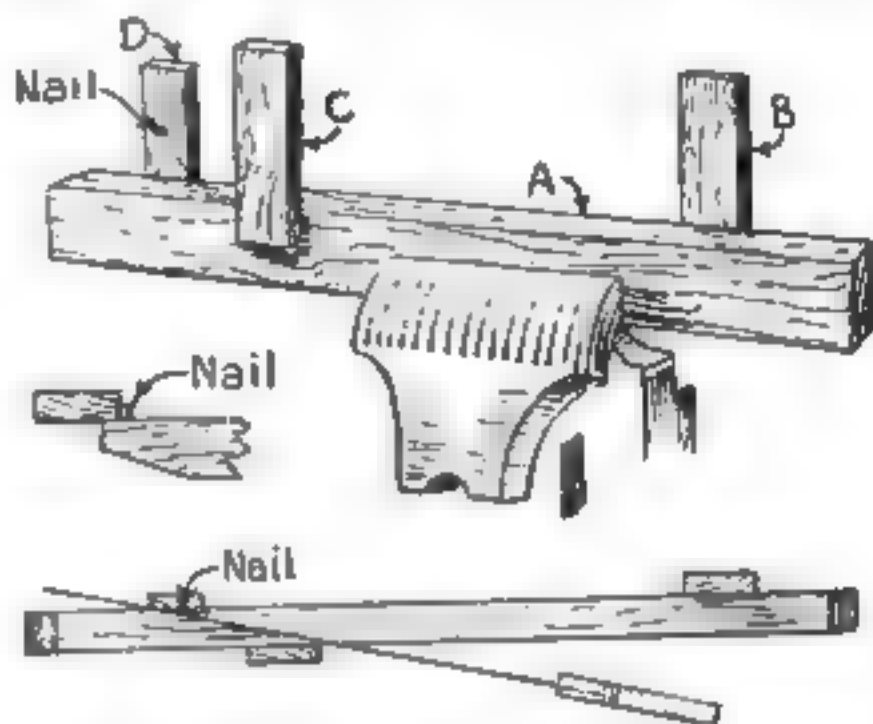
respectively intake and delivery. In the horizontal opening is placed a $\frac{1}{4}$ to 1-in. reducing bushing. A $\frac{1}{4}$ by 4-in. nipple is threaded for about 3 in. of its length and

started into the bushing.

When a few threads have passed the inner side of the reducing bushing, a $\frac{1}{4}$ in. street el is caught on the end of the nipple and is of course turned on as the nipple enters the bush. As a result the nipple will be tight in the street el when the lower or nozzle end of it is at about the center of the tee. The hexagonal upper portion is cut from a $\frac{1}{4}$ to $\frac{3}{8}$ -in. reducing bushing, leaving a nut, which is run up on the 4-in. nipple before entering it; but it is afterwards tightened against the $\frac{1}{4}$ to 1-in. reducing bush, affording a very practical lock for the nozzle. When the steam is turned into the $\frac{1}{4}$ -in. connection, the device will afford a very practical and satisfactory siphon for all common lifting purposes generally arising around the shop or plant. Even if the required fittings had to be purchased they would cost very little.—F. W. BENTLEY.

Making a Miter Box for Cutting Trestle Legs

IN doing some odd jobs one day I found that it was necessary to have a trestle, and as there was none at hand I collected



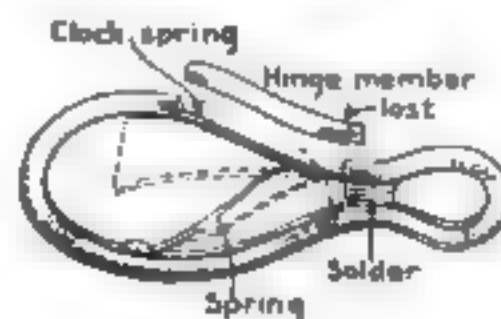
A piece of wood with gage sticks set in a vise to cut the miter on trestle legs

the material for making one. Then to cut the miters for the legs became a problem. I did not care to lay out each leg separately to cut the right miter. After making some calculations an emergency miter box was made as illustrated. It consisted of a piece *A*, of the same stock used for the legs, and three pieces *B*, *C* and *D*, nailed to the sides in such positions as to make the proper angle for the miter. A nail placed in the piece *D*, as shown, served as a stop.—JAMES M. KANE.

Replacing Tongue in a Fancy Brass Hook

A SET of four fancy brass snap hooks was given to me for repairs and on account of being unable to find a duplicate

I replaced the broken hinged member with a piece of flat clock-spring as shown. It was soldered in place instead of being riveted. The original tightening spring was left in place to straighten the clock-spring. A portion of the flat spring was cut off to allow more freedom in opening.—JAMES M. KANE.



A flat clock spring replacing a snap tongue

Why Some Foods Generate Deadly Poisons

By R. H. SINCLAIR

THE combinations of food that most people eat three times a day inflict nothing less than a crime against their health and are the direct cause of ninety per cent of all sickness."

This is the rather startling statement of Eugene Christian, the famous New York Food Scientist whose wonderful system of corrective eating is receiving so much eager attention throughout the Nation at the present time.

According to Eugene Christian we eat without any thought of the relation which one food has to another when eaten at the same time. The result is that often we combine two foods each of great value in itself but which when combined in the stomach literally explode, liberating toxins which are absorbed by the blood and form the root of nearly all sickness, the first indications of which are acidity, fermentation, gas, constipation, and many other sympathetic ills leading to most serious consequences.

All of this, states Eugene Christian, can be avoided if we would only pay a little attention to the selection of our daily menus instead of eating without any regard for the consequences.

This does not mean that it is necessary to eat foods we don't like; instead Christian prescribes meals which are twice as delicious as those to which we are accustomed.

Not long ago I was fortunate enough to be present when Eugene Christian was relating some of his experiences with corrective eating to a group of men interested in dietetics, and I was literally amazed at what he accomplished with food alone and without drugs or medicines of any kind.

One case which sticks in my mind was that of a prominent woman in New York City. She had gone to him with stomach and intestinal fermentation and gas, auto-intoxication, mental depression and anaemia, vertigo, and threatened heart failure. She was very much overweight when she commenced, but reduced her weight thirty-seven

pounds during the treatment. He showed me a letter she had written him afterward, in which she said:

"I am sure you will be gratified to hear that I continue to improve—it seems sometimes that I must have been made over, and it is difficult to remember that less than eight months ago I was a feeble old woman depending upon daily doses of strychnia for what little strength I had. When I came under your treatment, I weighed one hundred and ninety-seven pounds, was hardly able to walk, and was subject to most serious heart attacks upon the slightest exertion. And I am now so well, so strong, that my family and friends maintain that it is a miracle which has restored me to strength and vigor of life—certainly in my case the cure is most remarkable because of my sixty-seven years."

Another was a well-known minister who had been out of his pulpit for twenty-two months, unable to preach or conduct the simplest service. He was about twenty-five pounds under-weight, anaemic, nervous, had superacidity, and could not assimilate his food; and his heart action was very irregular. He had gradually declined for two years although treated by one of New York's leading physicians. Three months after he placed himself under Eugene Christian's care he preached the first sermon he had been able to preach in nearly two years. This was over three years ago.

He has gained about twenty-five pounds in weight, and since has not missed a day from his arduous clerical work. He has steadily gained in strength and vitality, and is to-day healthy and athletic.

Another case which interested me greatly was that of a bank cashier, confined to his desk for from seven to eight hours a day.

When he first consulted Eugene Christian he was very much run down in health, suffering from constipation and kidney trouble, and subject to almost constant and very severe headaches.

Only one month from the time he began to follow Eugene Christian's suggestions, his constipation was gone and the headaches had completely disappeared. These severe headaches, which had made continuous brain work almost impossible, were gone because the *cause*—constipation—was gone.

He pursued the treatment for three months with a gradual increase in weight, and at the end of that time practically every one of his former symptoms having disappeared, he wrote that he was "feeling fine all the time."

In order to reach more people who are in need of Eugene Christian's methods the Corrective Eating Society was founded to publish a series of 24 simple Lessons which he has prepared on Corrective Eating. These lessons are being sent as quickly as possible to all who request them for free examination. The lessons are not for sick people alone, but for all who wish to build up and maintain a reserve of bodily health and mental energy.

They are written in simple language, and every point is explained so there is little chance for misunderstanding. Reasons are given for every recommendation, and every statement is based upon results secured in the author's many years' experience.

But the lessons do not merely tell you why you should eat correctly and what the results will be; they also give actual menus for breakfast, luncheon, and dinner, covering conditions of health and sickness from infancy to old age for all occupations, climates, and seasons. They include *Corrective Menus* for stomach acidity, fermentation, constipation, and the host of diseases which follow when these "warnings" are neglected.

Every one of these menus has been employed for its purpose of increasing efficiency or restoring health not once but many times—so that every element of experiment has been removed. And an interesting feature in these days of high cost is that following these menus will cost you *less* than your food costs now.

Eugene Christian feels that every thinking man or woman—young or old—well or sick—should know the laws of Corrective Eat-

ing. For there is a great deal of truth in the old adage that "Most people dig their graves with their teeth." Food is the fuel of the human system, and just as certain fuels will produce definite results when consumed in a furnace, so will the right foods produce the desired results when put into the human furnace.

Yet not one person in a hundred has any knowledge of food as fuel. Some of the combinations which we eat every day are as inefficient and dangerous as soggy wood, wet leaves, mud, sawdust, and a little dynamite would be for a furnace. No wonder man is only 50 per cent efficient—no wonder the average life is only 43 years—no wonder diseases of the stomach, liver, and kidneys have increased 103 per cent within the past 30 years!

The "24 Little Lessons in Corrective Eating" show how easy and simple it is to eat your way back to normal health and up to a new type of physical and mental power. The relation of health to material success is so close that the result of eating Nature's way, as explained in these booklets, is a form of personal efficiency which often puts men head and shoulders above their brother-workers. For every one knows that the best ideas, plans, and methods are worked out when you are brimful of vitality—when you feel full of "ginger." The better you feel—the better work you can do.

If you would like to see the "24 Little Lessons in Corrective Eating," simply write the Corrective Eating Society, Inc., Department 610, 443 Fourth Avenue, New York City, and they will mail you a set for examination. It is not necessary to enclose any money with your request. Merely write and ask them to send the lessons for five days' free examination with the understanding that at the end of that time you will either remit \$3, the small fee asked, or return the lessons. You take no risk and if the more than 300 pages yield but one single suggestion that will bring greater health, you will get back many times the cost in personal benefit—yet hundreds write the Society that they find vital helpfulness on every page.

Merely tear out and mail this form instead of writing a letter. It is a copy of the official blank adopted by the Society and will be honored at once.

CORRECTIVE EATING SOCIETY, Inc., Dept. 610, 443 Fourth Ave., New York City

You may mail me the 24 Lessons in Corrective Eating for examination. 5 days after I receive them, I will either send you \$3 (full payment), or remail them to you.

Name Address

When writing to Advertisers please mention Popular Science Monthly

How I Raised My Earnings from \$30 to \$1000 a week

*The Story of a Young Man's
Remarkable Rise, as Told by Himself*

THREE years ago I was earning \$30 per week. With a wife and two children to support it was a constant struggle to make both ends meet. We saved very little, and that only by sacrificing things we really needed. Today my earnings average a thousand dollars weekly. I own two automobiles. My children go to private schools. I have just purchased, for cash, a \$25,000 home. I go hunting, fishing, motoring, traveling, whenever I care to, and I do less work than ever before.

What I have done, anyone can do—for I am only an average man. I have never gone to college, my education is limited, and I am not "brilliant" by any means. I personally know at least a hundred men who are better business men than I, who are better educated, who are better informed on hundreds of subjects, and who have much better ideas than I ever had. Yet not one of them approaches my earnings. I mention this merely to show that earning capacity is not governed by the extent of a man's education and to convince my readers that there is only one reason for my success—a reason I will give herein.

One day, a few years ago, I began to "take stock" of myself. I found that, like most other men, I had energy, ambition, determination. Yet in spite of these assets, for some reason or other I drifted along without getting anywhere. My lack of education bothered me, and I had thought seriously of making further sacrifices in order to better equip myself to earn more. Then I read somewhere that but few millionaires ever went to college. Edison, Rockefeller, Hill, Schwab, Carnegie—not one of them had any more schooling than I had.

One day something happened that woke me up to what was wrong with me. It was necessary for me to make a decision on a matter which was of no great consequence. I knew in my heart what was the right thing to do, but something held me back. I said one thing, then another; I decided one way, then another. I couldn't for the life of me make the decision I knew was right.

I lay awake most of that night thinking about the matter—not because it was of any great importance in itself, but because I was beginning to discover myself. Along towards dawn I resolved to try an experiment. I decided to cultivate my will power, believing that if I did this I would not hesitate about making decisions—that when I had an idea I would have sufficient confidence in myself to put it "over"—that I would not be "afraid" of myself or of things or of others. I felt that if I could smash my ideas across I would soon make my presence felt. I knew that heretofore I had always begged for success—had always stood, hat in hand, depending on others to "give" me the things I desired. In short, I was controlled by the will of others. Henceforth, I determined to have a strong will of my own—to demand and command what I wanted.

But how shall I begin? What shall I do first? It was easy enough for me to determine to do things—I had "determined" many times before. But this was a question of will power, and I made up my mind that the first step was to muster up enough of my own will power to stick to and carry out my determination.

With this new purpose in mind I applied myself to finding out something more about will power. I was sure that other men must have studied the subject, and the results of their experience would doubtless be of great value to me in understanding the workings of my own will. So, with a directness of purpose that I had scarcely known before, I began my search.

The results at first were discouraging. While a good deal had been written about the memory and other faculties of the brain, I could find nothing that offered any help to me in acquiring the new power that I had hoped might be possible.

But a little later in my investigation I encountered the works of Prof. Frank Channing Haddock. To my amazement and delight I discovered that this eminent scientist, whose name ranks with James, Bergson and Royce, had just completed

(Continued on next page)

the most thorough and constructive study of will power ever made. I was astonished to read his statement, "The will is just as susceptible of development as the muscles of the body!" My question was answered! Eagerly I read further—how Dr. Haddock had devoted twenty years to this study—how he has so completely mastered it that he was actually able to set down the very exercises by which anyone could develop the will, making it a bigger, stronger force each day, simply through an easy, progressive course of Training.

It is almost needless to say that I at once began to practice the exercises formulated by Dr. Haddock. And I need not recount the extraordinary results that I obtained almost from the first day. I have already indicated the success that my developed power of will has made for me.

But it may be thought that my case is exceptional. Let me again assure you that I am but an average man, with no super-developed powers, save that of my will. And to further prove my contention, let me cite one or two instances I have since come across, which seem to show conclusively that an indomitable will can be developed by anyone.

One case that comes to my mind is that of a young man who worked in a big factory. He was bright and willing, but seemed to get nowhere. Finally he took up the study of will training, at the suggestion of Mr. W. M. Taylor, the famous efficiency expert, and in less than a year his salary was increased 800%. Then there is the case of C. D. Van Vechten, General Agent of the Northwestern Life Insurance Company, Cedar Rapids, Iowa. Just a short time after receiving the methods in will development suggested by Prof. Haddock, he felt that they would be worth from \$3,000 to \$30,000 to him.

Another man, Mr. H. D. Ferguson, residing in Hot Springs, Ark., increased his earnings from \$40 a week to \$90 a week in a remarkably short space of time after he began the study of will training. These are but a few—there are many other equally amazing examples which I personally know about. And aside from the financial gain, this training has enabled thousands to overcome drink and other vices almost overnight—has helped overcome sickness and nervousness,

has transformed unhappy, envious, discontented people into dominating personalities filled with the joy of living.

Prof. Haddock's lessons, rules and exercises in will training have recently been compiled and published in book form by the Pelton Publishing Co., of Meriden, Conn. Mr. Pelton has authorized me to say that any reader who cares to examine the book may do so without sending any money in advance. In other words, if after a week's reading you do not feel that this book is worth \$3, the sum asked, return it and you will owe nothing. When you receive your copy for examination I suggest that you first read the articles on: the law of great thinking; how to develop analytical power; how to perfectly concentrate on any subject; how to guard against errors in thought; how to drive from the mind unwelcome thoughts; how to develop fearlessness; how to use the mind in sickness; how to acquire a dominating personality.

Some few doubters will scoff at the idea of will power being the fountainhead of wealth, position and everything we are striving for, and some may say that no mere book can teach the development of the will. But the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for me—and for thousands of others—what "Power of Will" has done—is well worth investigating. It is interesting to note that among the 200,000 owners who have read, used and praised "Power of Will," are such prominent men as Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Lieut.-Gov. McKelvie of Nebraska, Assistant Postmaster-General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Governor Arthur Capper of Kansas, and thousands of others.

As a first step in will training, I would suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, 14-S, Wilcox Block, Meriden, Conn., and the book will come by return mail. This one act may mean the turning point of your life, as it has meant to me and to so many others.

PELTON PUBLISHING COMPANY, 14-S Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will" at your risk. I agree to remit \$3 or return the book in 5 days.

Name

Address

When writing to Advertisers please mention Popular Science Monthly

Elgin Streamline

\$50-

In Solid Gold **



* The \$50 Streamline comes to your Jeweler complete in Solid Gold case and individual presentation box. The movement is the celebrated G. M. Wheeler model, with 17 Jewels and 5 adjustments * * * The same watch in 14 Karat Gold Filled, complete at \$35 *



The Streamline Series of Watches

for men brings the Elgin Company into the limelight as designers of *complete* watches.

For fifty years this great organization has designed and built watch *movements* of world famous excellence. Now it is designing both movement and case as a complete unit, under the sweeping Elgin guarantee.

The Streamline is a man's watch, dressed in a style that will last—perfect balance, perfect harmony of case and movement.

The design is notable for its smoothly flowing lines. The "close up" view at the left shows how the bow flows into the pendant, and the pendant into the curve of the case. The clear, spacious dial is equally distinctive.

Your Jeweler will take pride in showing you this new \$50 Streamline and the \$25 Streamline previously announced, also Elgin Bracelet Watches for women. Illustrated folders on request.

ELGIN NATIONAL WATCH CO., ELGIN, U.S.A.
Designers and Producers

When writing to Advertisers please mention Popular Science Monthly

Make this Chart your guide



Look for it on your dealer's wall

YOUR oil runs low. You stop for a fresh supply.

You now come to a vital question. What oil will the dealer pour into your oil-reservoir? Will it be just "oil"—or will it be the correct lubricant for *your* engine?

Among thousands of dealers this is what happens:

The dealer recognizes the make of your car—and the year's model. He runs his finger down the Vacuum Oil Company's Chart (shown above in miniature) until he finds your car's make and model. Then he supplies you with the grade of Gargoyle Mobiloils specified for your car by the Chart. This oil will effectively seal your piston rings against power-waste, gasoline-waste and oil-waste.

Why are thousands of dealers placing such reliance in this Chart?

Experience has taught them that something like 50% of all engine troubles are due to incorrect lubrication.

They realize that scientific lubrication is a problem for specialists. Since the dealer has neither time nor equipment for studying this intricate subject he draws on the experience of a recognized authority.

That is why you find on his walls the large Chart of Recommendations, issued by the Vacuum Oil Company.

If you inquire about the Chart you will find this:

The Vacuum Oil Company for 50 years have specialized in scientific lubrication. Today their world-wide leadership in lubrication matters is unquestioned in scientific circles.

For years their Chart of Recommendations has been recognized as the scientific guide to correct automobile lubrication.

In keeping this Chart up to date, each

We show you
what toasting
does for
tobacco



YOU have probably seen some of our men "demonstrating" in the store how we toast the tobacco for Lucky Strike Cigarettes.

They put a handful of Lucky Strike tobacco into a small pan and offer you this to sniff the fragrance.

Then they toast the tobacco over a flame and again offer it to you.

You notice at once how the flavor is brought out and increased by this toasting.

You owe the delicious new Lucky Strike Cigarettes to our development of this simple idea. The result is wonderful because the tobacco—

It's Toasted

© Guaranteed by

The American Tobacco Co.
INCORPORATED



Courier of Soldier and Civilian

Our troops are now on the firing line in France. While at home every instrumentality of our government and private industry is being urged at top speed to insure victory. The telephone is in universal demand as courier, bringing to the front men and the materials of war.

From the farms the telephone courier brings foodstuffs; from the mines the telephone courier calls forth metals; from the factories this courier gathers manufactured products. The telephone courier leads troop and supply trains to the front; summons fighting flotillas and transports; and,

in fact, leads practically every contributing unit of supply to the firing line.

At such a time, when the government is straining at its task and every industry is loyally contributing its energy, this national courier is constantly being used to call up the reserves. It is at the base of every contributing activity.

The right of way must be given to the military for the direction of troops and to the government for the marshaling of endless supplies. To do this, and also make the telephone serve all other needs, both patriotic and private, all must economize.



**AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES**

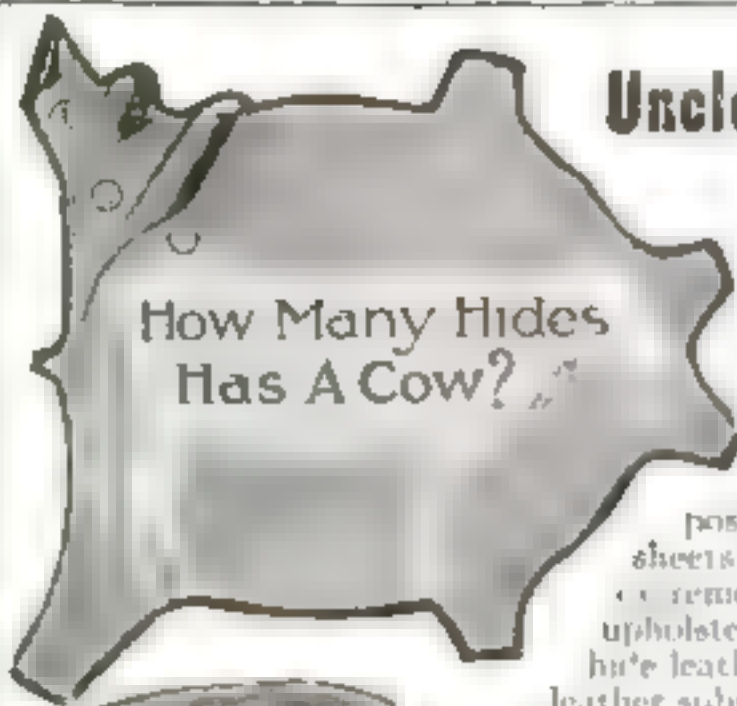
One Policy

One System

Universal Service

When writing to Advertisers please mention Popular Science Monthly

DU PONT AMERICAN INDUSTRIES



How Many Hides
Has A Cow?

Uncle Sam Knows The Real Answer: **NOT ENOUGH!** **Save Leather for Soldiers**

To make America's hide supply go as far as possible, hides are being split into five or more thin sheets, but, even this saving scheme fails to meet the requirements for soldiers' shoes, harness, equipment, ship upholstery, factory needs, etc., chiefly because too much hide leather is used by the public in places where high grade leather substitutes will serve as well or better.

For instance, the leather upholstery of one average size automobile would make twenty pairs of soldiers' shoes. For years America's largest producers of automobiles have successfully used Motor Quality Fabrikoid for upholstering their cars. Thousands of owners never even knew their cars were not upholstered in leather, because Fabrikoid looks and feels just like the finest leather and actually wears better than the coated split leather most used for upholstery of automobiles not covered with Fabrikoid.

Again, the furniture you buy with leather upholstery is probably covered with split leather that will not give service equal to



For Automobile
Interior Taps and
Upholstery



For Best Upholstery
Upholstery



For Furniture
Upholstery



For Bags,
Trunks and
Suitcases



For Books,
Diaries,
etc.



CRAFTSMAN Quality

That "genuine cowhide leather" suitcase of yours will probably reveal on inspection that its covering is only a pasted-on piece of split leather not much thicker or stronger than this sheet of paper.

It is true that some low high priced automobiles and pieces of furniture are upholstered in genuine grain leather of good quality and bags and suitcases are to be had at a price that are made of thick grain cowhide.

But the price of possession of luxurious, expensive leather should now yield to public preference for satisfactory substitutes that will divert this leather to more necessary uses.

UNCLE SAM HAS SET THE PACE

The new U. S. mail trucks and ambulances will be upholstered in leather substitutes.

For several years the standard for book binding in the Government Printing has been Du Pont Fabrikoid.

The upholstery specifications for the new Merchant Marine call for "Craftsman Quality Fabrikoid."

What Uncle Sam has found by experience and tests good enough for the Government's severe requirements should be good enough for every loyal American.

HOW YOU CAN HELP

If you are a manufacturer using leather, probably part or all of your requirements can be met by some grade of Fabrikoid. While not feasible for every use of leather the illustrations herewith show its wide range of utility.

If you use leather in your home for any purpose try the proper grade of Fabrikoid instead.

When buying an automobile seat or piece of furniture prefer Fabrikoid upholstery. Help the manufacturer conserve leather by patronizing those who use good leather substitutes—Fabrikoid.

Every hide displaced by a good substitute helps supply our armies with shoes, our farms with harness and our factories with belting. It helps win the war.

Manufacturers—write us your requirements and let us cooperate with you. Americans everywhere!—write for samples and names of manufacturers of the article you want who use Fabrikoid and of stores near you selling it by the yard.

DU PONT FABRIKOID COMPANY
Wilmington Delaware

World's Largest Manufacturers of Leather Substitutes
Factories at NEWBURGH, N. Y., ELIZABETH, N. J., FAIRFIELD, CONN., TORONTO, ONT.

DU PONT

1847—1917

CHASE Plush Motor Car Robes

Made by Sanford Mills

Of wonderful, fast colors,
they will outwear—many
times over—other woven
fabric robes. Say "Chase"
to your merchant.

L-C-CHASE & CO.

NEW YORK BOSTON CHICAGO

Leaders in Manufacturing since 1847



When writing to Advertisers please mention Popular Science Monthly

It Is EASY for You to Own a Beautiful Grandfather's Clock

Like This

Now Within Easy Reach of Anybody Who Wants One

As a matter of fact it is so easy and so amazingly low in cost that you will surely welcome this long looked-for opportunity to get one.

No home is really complete without a beautiful Grandfather's Clock and many tender associations are woven around it as it passes from one generation down to the next. It is more than a faithful keeper of time—more than a piece of furniture of exquisite beauty—it is a sentimental possession which you will treasure with more and more affection with the passing of time.

At a Cost of
Only \$25

You Can Own One of These Impor-
ing Grandfather's Clocks

Simply by
Assembling It Yourself

Without absolutely the first knowl-
edge of cabinet making, or any instinct
for construction of anything whatever,
and with but a few simple tools, you
can quickly assemble it in very short
order. And when it is all finished and
standing in your hall as a monument

to your handiwork, pealing forth the
hours, you will indeed be proud of it
and agree that had you paid \$100.00 or
more, you could not have purchased
one more beautiful or one that you
would cherish half so dearly.

Putting It Together Is As Simple As A.B.C.

Not a saw, chisel, or plane are needed.
The various parts come to you measured
with absolute accuracy. You positively
cannot make a mistake, because you
cannot put a single piece in any other
than in the place it belongs. To further
simplify the assembling of these Grand-
father's Clocks, we provide you de-
tailed printed instructions and blue
prints, which take you along step by
step through to completion.

We Sell To The Public Direct

By making these Grandfather's
Clocks in enormous quantities and
selling them to the public direct with-
out the expense of costly salesmen, and
by doing the actual assembling yourself,
we are able to put one of these treasures
into your home at a fraction of the
price that the completed article costs
in stores.

Write for a Copy of This Free Cata'og

Write us today for our interesting catalog on Clocks and
Chimes. It illustrates all the most popular and most beautiful
styles of Grandfather's Clocks and contains a wealth of in-
formation on the subject. Write for this book "THE
TINKER." today. *It's free*

A Big Money-Making Opportunity for You

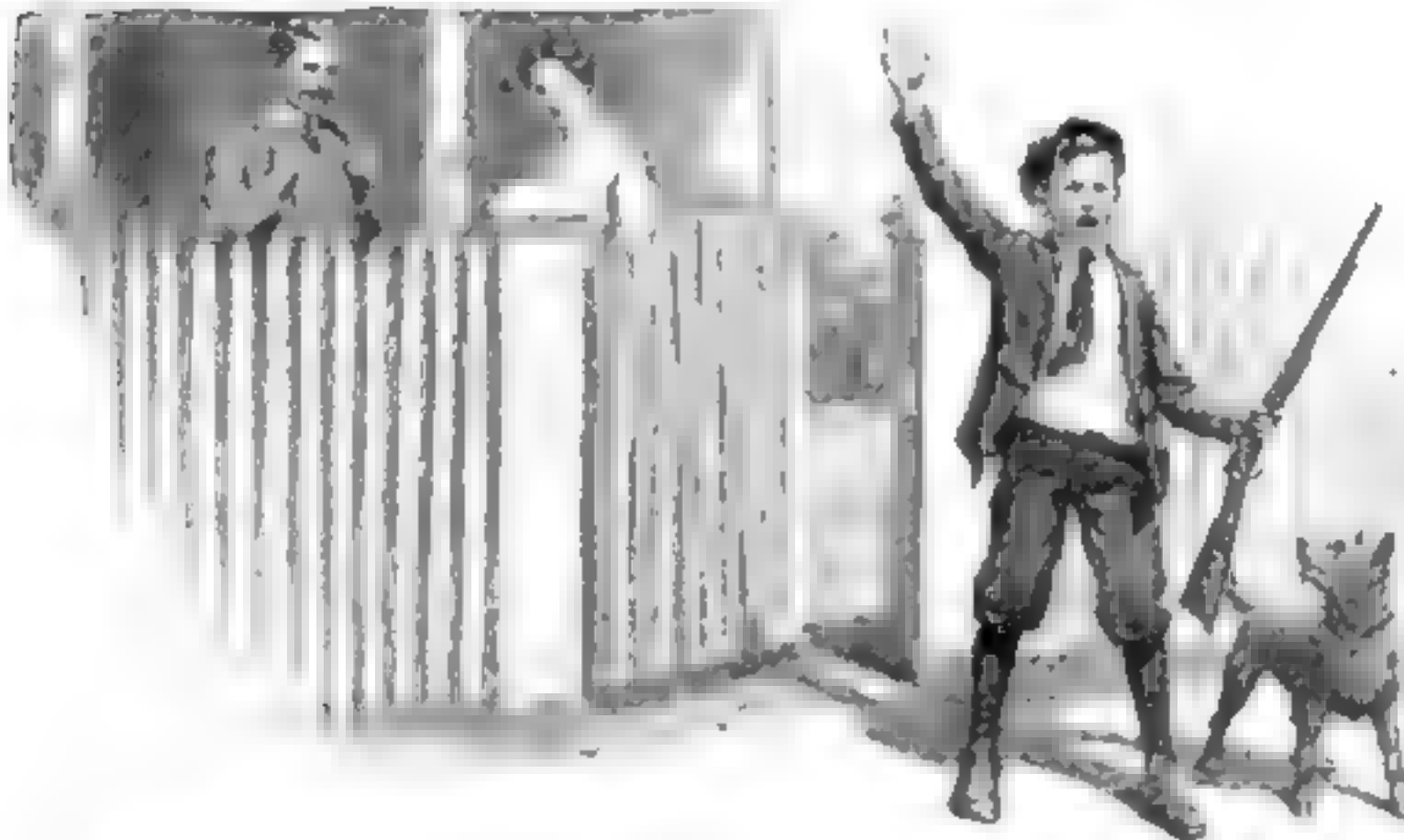
Hundreds of our customers have devoted their spare
time to assembling these Grandfather's Clocks and selling
them at a profit to their friends. Many are making \$50
to \$100 a week, for the profit is large. You can easily
get \$50 for a clock that costs you only \$25.

AMERICAN CHIME CLOCK CO.

1653 Ruffner Street
PHILADELPHIA, PA.



Write for
This
**FREE
BOOK**



"Oh, J-I-M-M-Y, come on over, we're goin' shootin'!"

Your boy's summer vacation is pretty nearly over now. Don't let him miss a single day of real sport.

Remember the fun you used to get out of your Winchester on those early fall days, just before school opened.

It's the boy's turn now. Give him a Winchester and let him have the same fun you had at his age. He's old enough now to have a Winchester of his own, to know the joy of trigger-magic.

What a gun will do for your boy

The sport of shooting is the greatest developer of mental resources—mental quickness, fair play, steady nerves, control, and the ability to mix in manly competition with companions.

A boy's natural interest in a gun is going to make him get his hands on one sooner or later, so the sooner you teach him the correct use of a gun the better. Remember that it is just as important for every boy to know how to handle a gun safely as it is that he should know how to swim.

Let your boy earn a Winchester Medal

To encourage marksmanship and the correct handling of a rifle among boys and girls of America we are awarding Gold Plated and Silver Plated Medals for skill with the Winchester 22 caliber rifle.

These Medals are awarded by the Winchester Junior Rifle Corps, an honorary club with membership among the boys and girls all over the United States. There are no dues and no military obligations involved.

Get your boy a Winchester rifle. Let him have the benefits that a gun will bring to him. Get him in on this Winchester competition which will teach him the correct use of a gun from the start.

What the name "Winchester" means

The name "Winchester" stands for the best traditions in gun making. For over half a century, Winchester has been the standard of pioneers and sportsmen. The Winchester Company today is an organization of expert gun makers with fifty years of gun-making reputation behind it.

Every gun or rifle that bears the name "Winchester" is fired many times for accuracy and smooth action, and with excess loads for strength.

No Winchester barrel varies one one-thousandth of an inch in thickness or diameter. The Bennett Process used exclusively by Winchester, gives the Winchester barrel a distinctive blue finish that, with proper care, will last a lifetime.

The same care that is taken with Winchester guns is taken with Winchester ammunition. The two are made for each other.

Let the boy have it now

Don't delay any longer giving your boy the benefits of a Winchester. There is a place near you, either in the open or at a club where he can go shooting. If you do not know where to shoot write us and we will tell you where and how you can, or we will help you organize a club.

Ask your dealer for our catalog and booklet on the proper use of a gun. If your dealer cannot supply you, write direct to us.

WINCHESTER REPEATING ARMS CO.
Dept. 87 New Haven, Conn.



BOYS AND GIRLS

Winchester Medals for skill with the Rifle

The Gold Plated "Sharpshooter" Medal goes to any boy or girl under 10 who makes the first grade score with a Winchester 22 rifle and Winchester ammunition.

The Silver Plated "Marksmen" Medal goes to the boy or girl who makes the second grade score.

Go to your dealer today, he will give you a sample target and booklet explaining the conditions of the contest. This booklet also tells you how to get the best results from your Winchester. The dealer will also supply you with plenty of targets.

If your dealer cannot supply you write to the Winchester Repeating Arms Co., Dept. 87, New Haven, Conn.



Model 06. Take-down repeating 22 caliber rifle. 20-inch round barrel. Holds three rounds of ammunition. The most popular 22 caliber repeater ever placed on the market.

Take-down 22 caliber single shot rifle. A low priced, light weight gun in two pieces.

WINCHESTER

World Standard Guns and Ammunition

When writing to Advertisers please mention Popular Science Monthly

Get the Bicycle Bug!

FREE—the beautiful green gold stick-pin shown here! It costs you nothing. Fill out the coupon below.

THESE are the days when bicycle riding is a real pleasure, and you'll find that a spin on the road is a double pleasure if your bike is equipped with United States Tires—the **GOOD** tires.

Twelve different types from which to choose the one that fits your needs.

Get the Bicycle Bug! Fill out the coupon **NOW**.

UNITED STATES TIRE COMPANY

1793 Broadway, New York



Fill Out _____ Tear Out _____ Mail Today _____

UNITED STATES TIRE COMPANY, 1790-C Broadway, New York.

GENTLEMEN:—Please tell me how to get one of your beautiful green-gold bicycle bugs free.

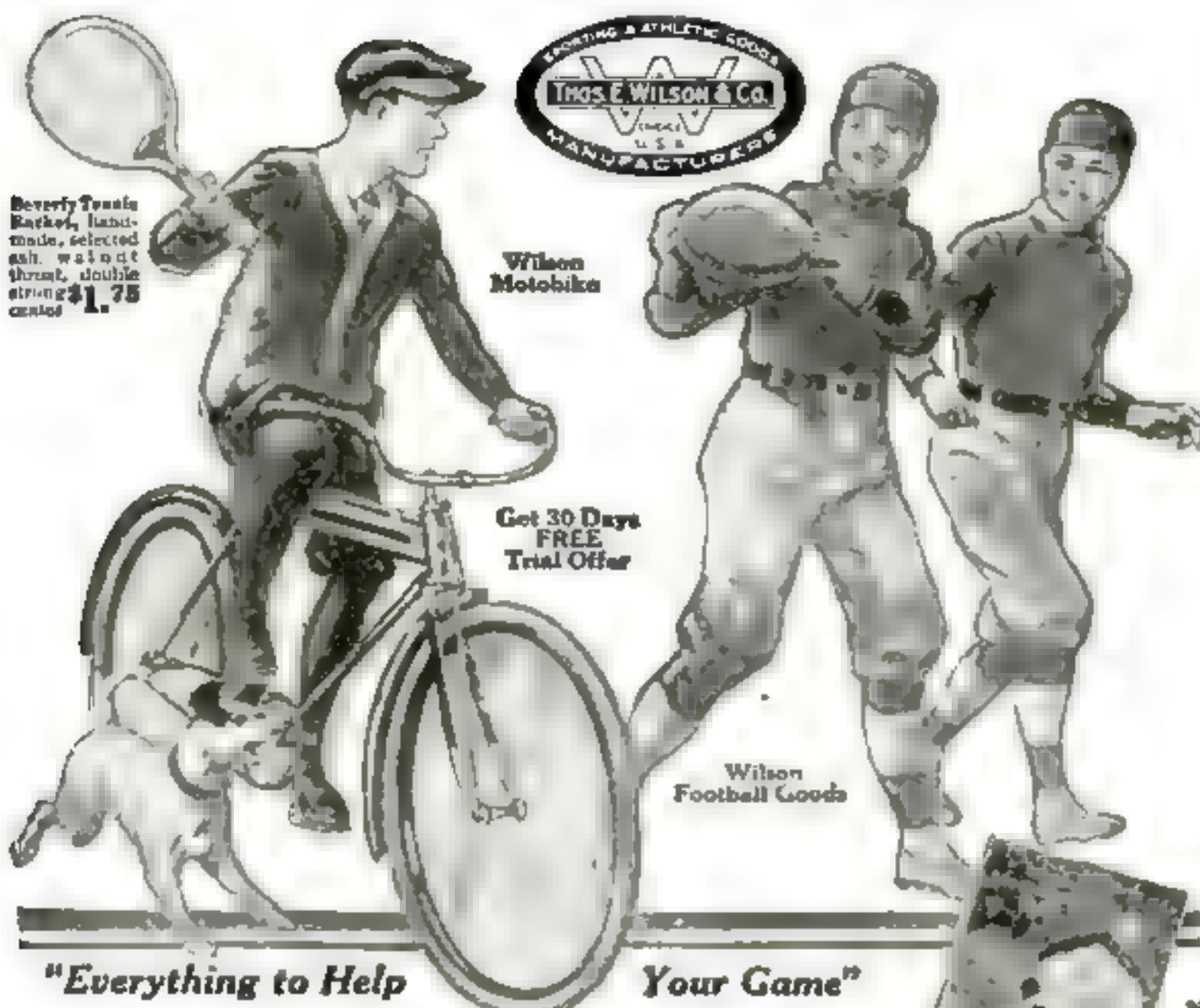
Full Name.

Address.

Name of Nearest Bicycle Dealer.

Address of Dealer.

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- Athletic Shoes
- Baseball (Official)
- Baseball Uniforms
- Baseball Bats
- Baseball Shoes
- Bathing Suits
- Basket Balls
- Basket Ball Equipment
- Bicycles
- Bicycle Tires
- Equestrian Clothing
- Fishing Tackle
- Football Equipment
- Golf Clubs
- Golf Balls
- Golf Apparel
- Golf Course Equipment
- Gymnasium Equipment
- Indestructible Golf Bags
- Jackets
- Sweaters
- Shoes
- Tennis Rackets
- Tennis Balls
- Tennis Equipment
- Track Equipment
- Yachting Clothes

Get 30 Days FREE Trial Offer

Wilson Football Goods

"Everything to Help Your Game"

Boys! Get This Big Wilson Sporting Goods Catalog Free

New fall sporting goods catalog and free book, "How to Play and Coach Football," by John R. Richards, Coach at the University of Wisconsin

The winner in any contest owes his success almost as much to his equipment as to his own ability. Following this principle, Wilson Goods have been carefully designed by well-known sportsmen and athletes of long experience with

the idea that they must help your game. They are Wilson from the time the raw materials leave the great Wilson & Co. packing plant until they are finished in Wilson factories under the supervision of experts.



The A5 Wilson Official Intercollegiate Football is fully guaranteed. Made of selected pebbled grain leather, specially tanned. Each official A5 ball is stamped with the Wilson W. Packed complete with pure gum bladder. Lacing needle and rawhide laces. The ball with patented double lacing features. Each — **\$7.00**



The J4 Wilson Official Intercollegiate Basket Ball. Made in four sections with capless ends, and of finest and most carefully selected pebbled grain leather, specially tanned. Has our patented Double Lacing feature. Packed complete with pure gum bladder, lacing needle and rawhide laces. Demand the Wilson and accept no substitutes. This ball was adopted by the National A. A. U. championship. Used and endorsed by practically every prominent university in the country. **\$10.00**

Other footballs \$1 each and up.
Other basketballs \$1 each and up.

and college in the country Complete — **\$10.00**

The Wilson Motobike represents the best and newest in bicycle construction and equipment. Double bar construction on frame. New departure Cassette Brake. Heavily padded leather top saddle. Invincible tires. Handsomely equipped with four coats of French gray. Head center of rims steel guards and tank enamel. **\$38.00**



43rd and Hermitage Ave., Chicago, Ill.

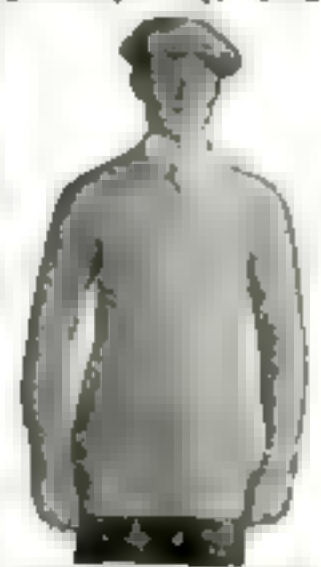
THOS. E. WILSON & CO., 43d St. & Hermitage Ave., Chicago 78

[] Please send me your free books and illustrated catalog of sporting and athletic goods.
 Find enclosed \$ _____ for which please send me articles that are checked.
 [] Beverly tennis racket, weight [] A Football.
 [] H4 V-neck sweater, size [] B300 Gymnasium Blonners, size ____
 [] Wilson Motobike, [] J4 Basketball. [] B300 Middy, size ____

My dealer, Mr. _____ does not handle Wilson goods.
 Name _____ Address _____



FOR GIRLS
 No. 5300—Blouse. Special patterned elbow sleeves, double yoke front and back, faced front, made from the quality bleached twill cut so that arms may be raised above head without pulling blouse up at hips, as with ordinary blouses. Sizes 22 to 44. Each **\$1.50**
 No. 5302—Gymnasium Blonners. Made extra full with plaited waist, very popular pattern. Made from good quality serge in Navy Blue or Black. For pair **\$2.00**



No. 574—V-Neck Sweater. Medium weight. Made in our own factory of high quality pure wool yarns with special long fibers. In Ivory, navy blue, mustard and cardinals. Size in collar and sleeves to order. **\$5.50**

When writing to Advertisers please mention Popular Science Monthly



"He's got an Ingersoll Radiolite"

THERE'S joy in that boy's heart — for every boy loves his Ingersoll Radiolite Watch! And the other boys envy him — as they would you.

You — and every other boy — need an Ingersoll Radiolite. It gets you to school on time, and it brings you home on time. You never miss that first tense minute of a ball game. You catch trains and boats. Oh, it's real to have one of these men's watches.

And Ingersoll Radiolites tell time in the dark. No matter how black the night or the room, they always show the time clearly. Look at the day-and-night photograph of the Ingersoll Waterbury Radiolite Model. Real radium

in the Radiolite hands and figures makes them glow as long as you have the watch.

It's just this radium that makes them photograph in the dark. Take your Radiolite into a pitch black room and lay a photographic plate over it for 20 minutes. When it's developed you will have the same picture you see here.

Ask Dad to get you one of these wonder watches. Go to your dealer, and ask him for a 24-hour trial coupon. He'll return Dad's money if you don't agree that this is the greatest watch you ever saw. Take the coupon to your dealer now.

ROBT. H. INGERSOLL & BRO.

New York

Boston

Chicago

San Francisco

Montreal

Ingersoll Radiolite Watches, \$2.25 to \$4.25. Other models, \$1.35 to \$6.00

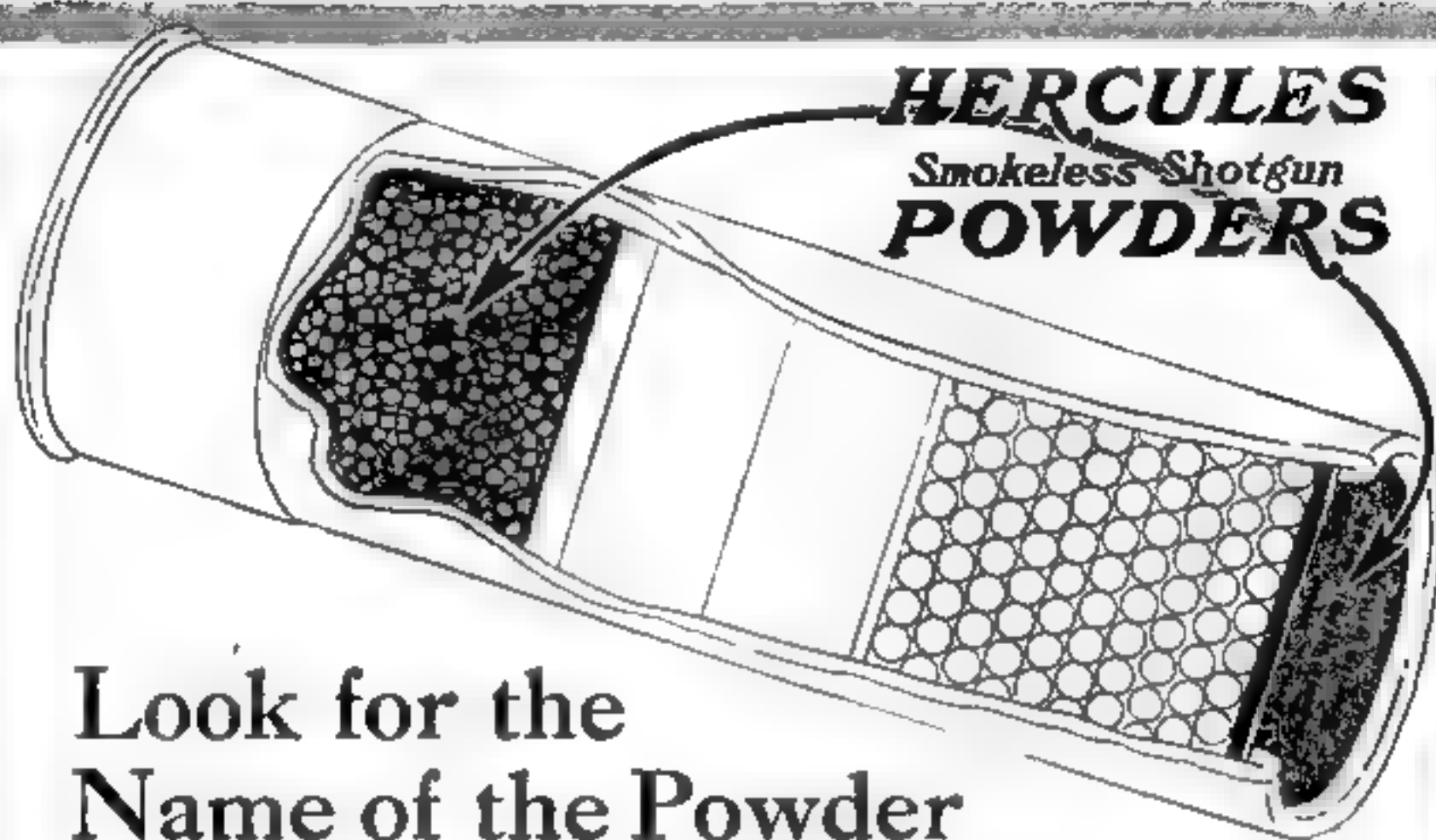


Not a Boy's Watch — but the Best Watch for Boys, and Girls too.

Marmon closed cars,
built by custom coach
builders actually weigh
less than competitive
touring cars. Nor can
compare with Marmon a
luxurious sense of 155 m.p.h.
an hour, whether in
boulevard or open road.

**NORDYKE & MARMON
COMPANY
INDIANAPOLIS
U. S. A.**





Look for the Name of the Powder

ANY sportsman who gives the matter a moment's thought will agree that the powder contained in the shotgun shells he uses is a factor of prime importance to him when shooting either in the field or at the traps.

This being so it is a matter of ordinary prudence when buying loaded shotgun shells to specify that they be loaded with a powder with which you are familiar—a powder upon which you can depend under all circumstances.

You get such a powder when you specify either Infallible or "E. C."—the two Hercules Smokeless Shotgun Powders.

Undoubtedly the name of your favorite make of shell is given in the list at the right. You can obtain either of these Hercules Powders in *that shell* by asking your dealer for it.

On the top wad of every shell, and on the cover of the box in which the shells are sold, is printed the name of the powder with which the shell is loaded. Look for this name when buying. See that it is either Infallible or "E. C."

These powders are of high quality and uniform quality. They give light recoil, even patterns, and high velocity. Write for a free booklet which describes them fully.

Infallible and "E. C." can be obtained in all of the following makes of shotgun shells.

PETERS
REMINGTON
SELBY
U. S.
WESTERN
WINCHESTER

HERCULES POWDER CO.

1041 Market

Street

Wilmington

Delaware



Gillette U. S. Service Set

It Fits the Kit or the Pocket

HERE is how the Great War developed the most compact and efficient shaving outfit in the world.

From the start, all the Allied Armies called for Gillette Razors—first by thousands, then by hundreds of thousands. All sorts of sets—leather, metal, Standard Sets and Pocket Editions. The demand finally centered on the Metal case: they stood the racket. Suggestions came from every front.

A year ago our own boys were called to the Mexican border among them a young Officer from the Gillette Organization. He came back with an idea of what the Gillette means to the

fighting man—the best model to go in the soldier's Kit or the sailor's Ditty-box!

We went to work on a Service Model—sifted all the suggestions, all the ideas, and developed them. When Uncle Sam jumped into the Big War the Gillette was ready to do its bit.

So here is the new U. S. Service Set, a solid metal case, heavy nickel-plated and embossed with the insignia of the U. S. Army and Navy. Strong, thin, compact, 1 1/2 inches wide, 4 inches long, 3/8 inch thick. It fits the Kit or slips into the breast pocket of the shirt or coat. Contains a nickel-plated Gillette Safety Razor, Blades and Blade Box, Indestructible Trench Mirror inside the lid.

Price, \$5



The U. S. Army Regulations call for a shaving outfit. Every man has to bring his own. Here is his favorite razor and the one that takes up the least room. You ought to see the boys reach for them! Every man in Khaki ought to have one.

If you're a friend of his give it to him, or get it to him. Most gifts he will have to leave behind. This one he will carry with him and use every day. No Straps or Hinges. Nothing to carry but the compact little case, and new Blades can be had anywhere in France, England, Russia and Italy.

The Gillette U. S. Service Set is a leading specialty with Gillette Dealers everywhere.

Gillette Safety Razor Company
Boston, Mass., U. S. A.

Gillette Safety Razor Company
of Canada, Ltd.

72 St. Alexander Street, Montreal

If he has already gone, you can send him a Gillette U. S. Service Set by mail. If your dealer does not have to a Set send us his and your Sammie's address and we will make free delivery direct to his hands from our Paris Office or to any American Consulate from our New York Office.



USED IN THE ARMIES AND NAVIES OF THE WORLD

Your boy needs a

PRICE
\$1.50 up
Parker
Clip, 25c
more

Easy
to Fill

Press
the Button

PRICE
Sterling
Silver, \$5
18-K Gold
Plato, \$6

PARKER (SAFETY-SEALED) FOUNTAIN PEN

Drop ink
tablet
in water



New Parker
PATENT CLIP
held in place like
a WASHER

\$1.50, \$1.75, \$2.00
at leading
dealers.
Catalog free

Drop ink
tablet
into fluid ink



SAFETY SEALED—The new type "see hole in the wall" fountain pen. Ink can't get out to soil clothes or person. In event of accident or accident to the fountain pen, pen automatically changes from Sell Filler to non Sell Filler, no interruption in service.

PARKER INK TABLETS

For a soldier's "kit"
in place of fluid ink

10 cents per box of 16 tablets.

PARKER PEN COMPANY, 244 Mill Street, Janesville, Wisconsin; New York Retail Store, Woolworth Building



KEEP YOUR CAR YOUNG
PAINT IT YOURSELF WITH

Effecto AUTO FINISHES

A coat or two of Effecto will do the trick, without the loss of your car for more than one or two days. Not a wax or polish, but a durable, quick-drying, high-luster auto enamel, made in seven beautiful colors. Sold by paint, hardware and auto accessory dealers. Send for Color Card. Pratt & Lambert Inc., 155 Tonawanda Street, Buffalo, N. Y. In Canada, 101 Courtwright Street, Bridgeburg, Ontario.

MADE BY THE MAKERS OF
PRATT & LAMBERT VARNISHES

Do This

Before you
put a tool
away treat
it to a little
3-in-One



Oil the action parts of automatic tools. Wipe all tools and their wooden handles with a soft cloth moistened with 3-in-One. Then you'll find your tools in perfect working condition the next time you use them. This is a small thing to do, but every tool user will find it produces great big results.

3-in-One



is the one right oil for tools. Lubricates automatic drills, screw drivers, brace-and-bits in perfect ion. Never gums or collects dirt. Prevents rust on edge tools. Makes saws work much easier. Cleans and polishes the wooden handles. Try 3-in-One is sold at all stores—in 25c Handy Oil Cans and in 15c, 45c and 50c bottles.

FREE—Generous sample of 3-in-One Oil and Dictionary of Uses—both free for the asking.

Three-in-One Oil Co.
165 KCT. Broadway New York

The Inspiration of a Woman's Needs Produced this New Kind of a Sewing Machine



Keep it on the closet shelf.



Carry it upstairs or down.



Put it on any kind of a table.



Connect to any light socket.



Take it with you when you travel.



The ordinary foot-power sewing machine is a clumsy affair. You cannot easily move it around, so you must bring your work to it. It is no ornament and takes up a lot of room. The woman who uses it pays dearly in a tired body and tired nerves.

Western Electric Portable Sewing Machine

The heavy unnecessary parts of the old-fashioned machine are eliminated. With motor complete is no larger than a typewriter, yet it has all the attachments and will do the work of any sewing machine.

The speed is controlled by a touch of your foot and you can run the machine for five hours on one and a half cents' worth of electricity. With a Western Electric 2-way Plug you can operate both the machine and a lamp from a single socket at the same time.

If your lighting company or electrical dealer cannot show you this new kind of sewing machine, write to the nearest office for Booklet No. 516-AT.

Costs Only **\$35**

(\$37 West of the Rockies)

WESTERN ELECTRIC COMPANY, Inc.

WESTERN ELECTRIC COMPANY, Inc.

New York Chicago
Kansas City San Francisco
Houses in all Principal Cities

Gentlemen
Please send me Booklet No. 516-AT, describing your portable electric sewing machine.

Name _____

Address _____

\$7.50 MAKES YOUR FORD A HIGH POWERED CAR



\$7.50 is the price of a
set of 12

AMERICAN HAMMERED PISTON RINGS

Install a set of these rings in your Ford Car and these are the results we guarantee:—

10% to 30% more power

25% to 50% more mileage from gasoline

50% to 75% less oil consumption

No more carbon or spark plug trouble and no more smoking.

If within one year after installing a set of 12 AMERICAN HAMMERED PISTON RINGS you are not satisfied with results, return rings to us and money will be refunded.

We do not advise the use of Piston Rings made of more than one piece. If you want to know why, write us. It will pay you to re-equip your motor with AMERICAN HAMMERED PISTON RINGS no matter what other piston rings you are using.

Buy American Rings from your garage man or accessory dealer. If they can't supply you send \$7.50 in check, postal or express money order to us. Our rings are easy to install.

We Want Agents and Dealers

To enterprising men we will allot exclusive territory. The national reputation of AMERICAN HAMMERED PISTON RINGS makes them easy to sell. THEY'RE A NECESSITY, NOT A LUXURY.

Instructive and Interesting Booklets, "Story of the Magic Ring" and "The Soul of the Motor," sent on request.

AMERICAN PISTON RING SALES CO.

210 Halsey St.

Newark, N. J.



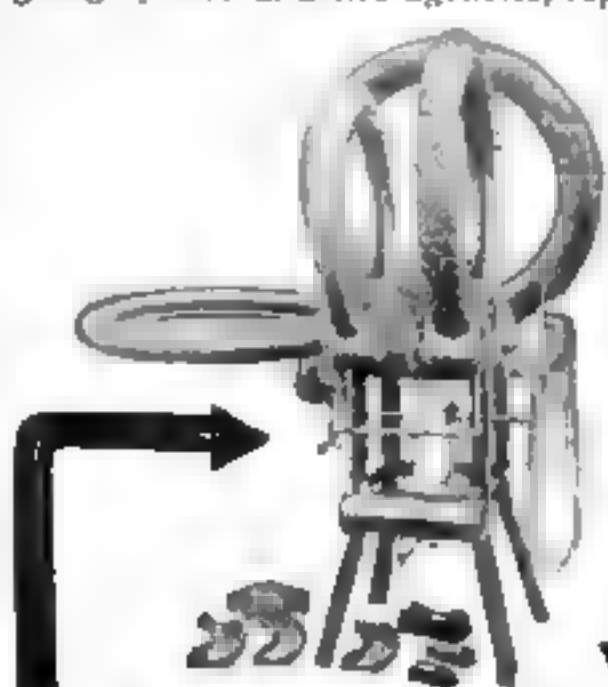
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Winton, Mercer, Stearns,
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White, Kelly-Spring-
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\$2500. to \$7500. ANNUAL PROFITS

ANDERSON STEAM VULCANIZER

Men wanted everywhere to get into vulcanizing business using the greatest vulcanizing machine on the market. Big demand—large profits. 25,000,000 tires sold in 1917—millions to be repaired. Act now—"cash in" on this new game. An easily handled side line—garages, auto and tire agencies, repair shops,

harness shops can "clean up" by installing an Anderson Vulcanizer.



The
Anderson
Vulcanizer

Uses Unlimited Pressure

Air bags, as used on many machines, and costing \$2 to \$5, take only 90 lbs. pressure, are unsatisfactory, and **do not really vulcanize**. We use NO air bag pressure. Our flexible conformation device takes TONS of pressure—it assures true vulcanization inside and out, at one operation. Anderson process forces rubber and cement at curing heat into the fabric—cooked in—making a perfect union. Work will not lump, blister or pull loose. Run cuts repaired perfectly.

REPAIRS TIRES AND TUBES—Anderson outfit repairs everything from 1½" bicycle tires to 37" x 5½" auto tires. Machine shipped complete ready for use. **PAYS OUT IN WEEK.** \$160 its daily capacity. Keep molds reasonably busy; you'll clean up enough first week over all expenses to pay for machine and leave a handsome profit beside.

State Organizers and District Sales Managers wanted—actually the "best seller" on the market.

Anderson Steam Vulcanizer Co.
3 Industrial Building Indianapolis, Indiana



**TURNS
EASY**

A rusty or sticky cylinder responds quickly to

HOMOL
TRADE MARK

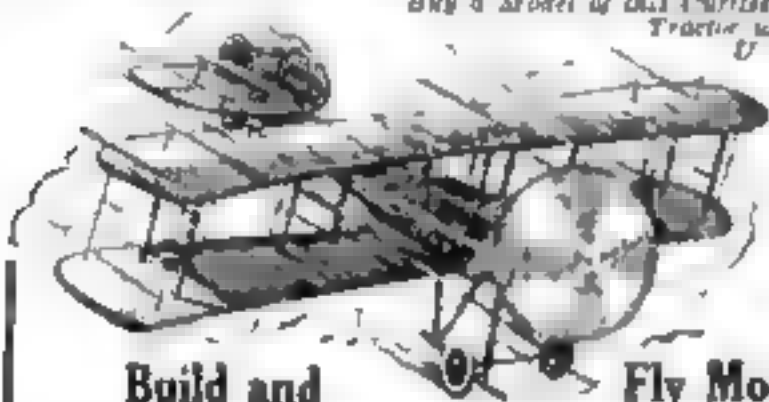
Get this sportsmen's oil—excellent for guns, reels, traps and tools, and for every use around the house.

If your dealer cannot supply you with Homol, we will—just send us his name and 25 cents for a 5-ounce can—quick.



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Build and Fly Model War Aeroplanes

that are perfect copies of real, war-famous airships, that rise from the ground by their own power and fly 50 to 100 feet in the air. It's easy! We furnish IDEAL Accurate Scale Drawings and Building and Flying Instructions which show how to construct a 3-foot Model Aeroplane that will fly.

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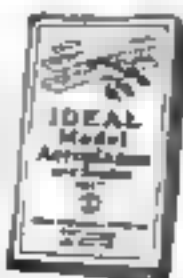
Curtiss Military Tractor	25c <small>EACH in lot \$1.75</small>	Wright Biplane
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IDEAL Aeroplane Construction Outfits, containing all parts and materials needed to build these Aeroplanes are sold by leading Toy, Sporting Goods and Department Stores. Ask your dealer for IDEAL Aeroplane Construction Outfits. They make building easy!

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Tells about Model Aeroplanes and how they are built. About Racing Aeroplanes and Flying Toys. Lists all kinds of parts and supplies to build them with. 48 pages for five cents. Send for it today.

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Grinnell's Great Outdoor Glove

4400-B



This light weight Grinnell coltskin glove is ideal for automobiling, hunting, fishing, rowing and all outdoor sports.

It is soft and pliable, sturdy and stylish.

Washable in soap and water or gasoline. Dries out like new. Sliding tape fastener gives snug fit at wrist.

There are over 600 styles of Grinnell Gloves, for dress, motor-ing, work and every other purpose.

We maintain the famous Grinnell quality, despite the world-wide leather shortage. Insist on genuine Grinnells.

Style Book Write for it today. Ask **FREE** your dealer to show you the "4400-B" outdoor glove. If he hasn't it, send us his name and size of glove you wear, and we will send you a pair on approval—charges prepaid. **Morrison-Ricker Mfg. Co., 142 Broad Street, Grinnell, Iowa.**

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Best for Every Purpose

How War-Rushed Producers Speed Up Machines

Accurate count is taken of each machine's output. Every means is taken to *increase* this count. Mechanical improvements, more scientific operation—every efficiency-gain *shows in the figures*. Thus accurate guidance is had in experimenting.

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COUNTERS

tell the number of reciprocating movements or revolutions, registering the production of practically any machine. Whether you develop machinery or operate it for profit, you can work more successfully with Veeder Counters to guide you.



The above-shown SET-BACK REVOLUTION COUNTER registers one for each complete turn of a shaft. Quickly set back to zero by turning knob. Price, with 4 figure-wheels, \$8.00

The ROTARY RATCHET COUNTER shown at left registers reciprocating movements. When

lever is moved through an angle of from 40 to 60 degrees, the counter registers one. A complete revolution registers ten. A most adaptable counter for special conditions and experimenting. Price . . . \$1.25

We have an instructive booklet showing counters for all purposes. Would you like a copy?

THE VEEDER MFG. CO.
44 SARGEANT ST., HARTFORD, CONN.

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Live
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Only

Each Memo Separate

—tear out when attended to

ROBINSON REMINDER

Each memo a perforated segment, which, when attended to, is torn out. Live notes only. No searching for obsolete notes. Everything ready for instant reference. Handy pocket in cover.

With each Reminder is an extra slip

Handsome Black Leather	3 in. x 5 in.	2 1/2 in. x 1 in.
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Robinson Mfg Co., 44 Elm Street, Westfield Mass.

Folding DOUBLE X-RAY



With this Double X-RAY you can apparently see thru cloth or wood. See bones in the body, makes the flesh look transparent. A optical illusion. By mail 10 cts. three for 25 cts. Postpaid Arden Co. Box 212 Stamford Conn.

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Cameras, lenses and supplies of every description. We can save you 25 to 50 per cent on slightly used outfits. Write at once for our free

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Being in a hurry to get a good deal on cameras and supplies? Write at once for our free Bargain Book and Catalog. It is a must for every photographer. It is a must for every photographer. It is a must for every photographer.

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Test this
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KOR-KER PUNCTURE CURE

Seals punctures instantly—Stops slow leaks. Reduces blowouts to a minimum. Preserves tubes. Increases mileage. Keeps tires at normal inflation. Not a filler. 5 years success. These are absolute facts. We guarantee them. Booklet gives details and proof. Write today for Chemist's, Tire Mfr's and Car Owner's reports. You will be convinced.

We Want Able Men

as Local Distributors for Kor-Ker Puncture Cure. Can make \$100 and more a week. We need the big men who can close the leads developed by our national advertising. Car owners preferred. Must handle small retail orders in return for exclusive selling rights. We make most thorough investigations.

ALCEMO MFG. CO., 6 Bridge St., NEWARK, N. J.

**The Haywood Tire
Repair Shop of
Paul R. Fredricks
Wallingford, Conn.**

*Now doing an average
business of
\$450 a week.*

YOU TOO CAN MAKE BIG MONEY.

We need immediately, more men like Paul R. Fredricks to manage Haywood Tire Repair stations. "Just a year in the business and now doing \$400 to \$450 a week at a good round profit" tells the story of this ambitious young man's rapid rise to fortune. Scores of men like Fredrick have found their independence in the Tire Repair business, have opened Haywood shops and are making big money. The coupon below or a post card with your name and address will tell you how to start. Send today.

Tire Repairing Revolutionized!! Motorists To Save Millions In Tire Expense.

The Haywood method of tire-repairing is different—*Scientific*. It strikes a new chord in tire economy. It is efficient—saves time—increases mileage—lasts. It has required years of experience to develop it. Practical tests have proven it. Its superiority is acknowledged—accepted by those who know, as a *Triumph*.

30 Million Tires to Repair.

The demand for tire repairing is now so great that more Haywood stations must be established at once throughout the country. We want capable, energetic, ambitious men in charge of each—men who are dependable—competent. You can have this opportunity—share in the Haywood success—become a link in a mammoth chain of a country wide, thoroughly efficient Tire Repair Service.

Make \$3,000 a Year or Better!

You Own Your Own Business! Keep Your Own Profit!

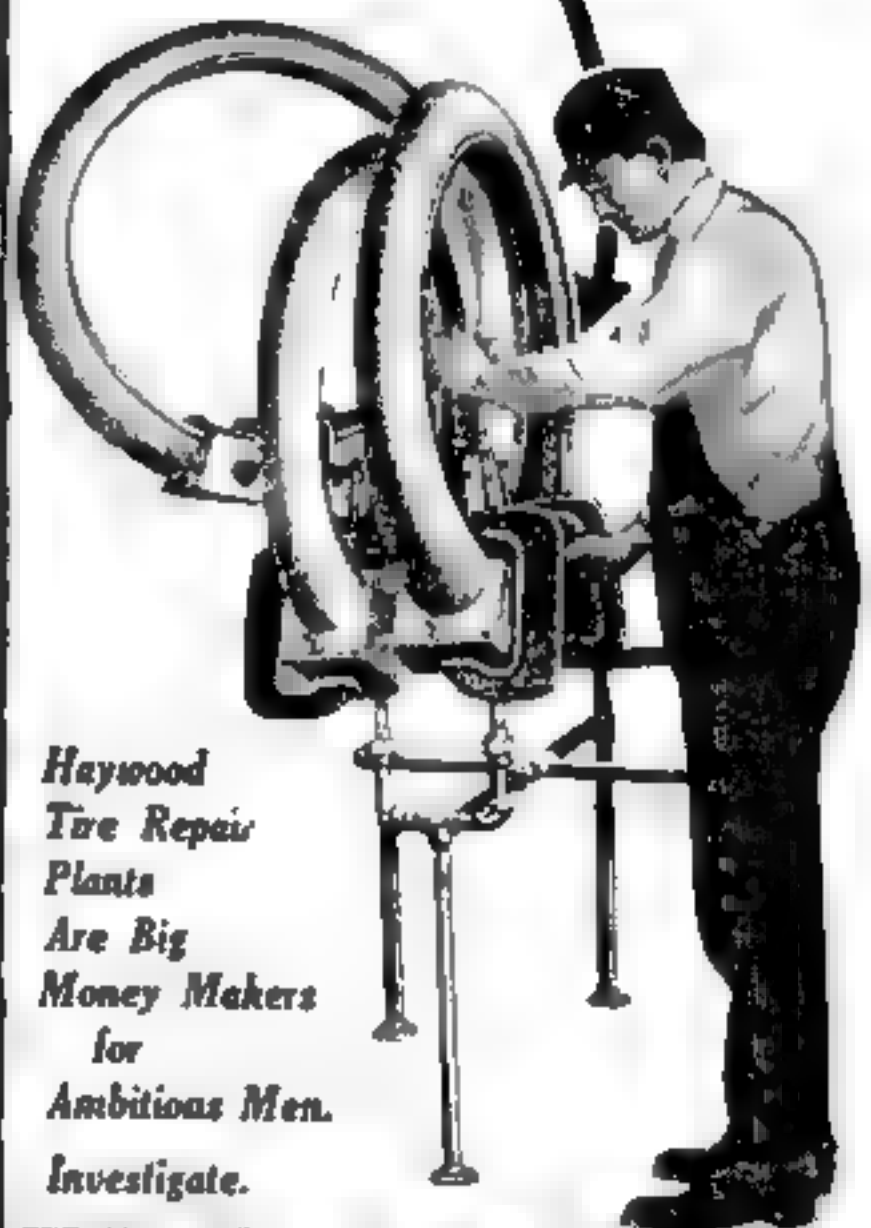
Haywood equipment is sold outright. We teach you Haywood Scientific Tire Repairing in our Laboratory especially equipped for this purpose. Here you learn all about tires—the inner mechanism of construction—how to repair *scientifically* every tire injury. This training is thorough—practical and equips you to give Haywood Service of the standard we advertise nationally and are so careful to maintain—the service that saves motorists millions of dollars in tire up-keep.

A Wonderful Opportunity.

The coupon—your name and address, brings full particulars. How to start. How to tie up with the Haywood Service. We'll give inside facts and figures about costs and profits. Explain in detail our Co-operative Business Building Plans. Write today without fail. Learn how you can start at once.

Haywood Tire & Equipment Co.

967 N. Capitol Ave., Indianapolis, Ind.



**Haywood
Tire Repair
Plants
Are Big
Money Makers
for
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Investigate.**

Mail this Today

HAYWOOD TIRE & EQUIPMENT CO.

967 N. Capitol Avenue, Indianapolis, Ind.

Gentlemen

Please send full particulars of your Scientific Tire Repair Service and details of your Co-operative Business Building Plans.

Name

Address

To The Man Who Walks

If you walk to your work or to your play; if you ride on street cars or elevated trains or if you are considering the purchase of a cheap automobile

THIS MESSAGE IS FOR YOU

The following quotations are from an article by A. Ludlow Clayden which appeared in **AUTOMOBILE & AUTOMOTIVE INDUSTRIES**, a publication devoted primarily to the interests of the automobile.

"—for the use of two people in fair weather the motorcycle and sidecar will give the same service as a two-seated car at not more than one-quarter the cost.

"For those who love speed it can only be surpassed by cars costing well up into the thousands of dollars.

"Its rapid getaway and hill climbing ability—its intense "life" cause it to appeal to the class of man who likes to use a powerful roadster.

"—motorcycles now being made are comparable in en-

gineering quality and workmanship with cars that sell from \$2000.00 upward—the touring car which will hold five or more is very apt to force entertainment expense upon the owner.

"—a sidecar is vastly more comfortable than the majority of full-sized automobiles—more easily housed—less trouble to use for short distances than a car owing to its small size and consequent ability to work its way thru traffic.

The foregoing, coming from an automobile paper, should convince the dubious that the motorcycle is the thing to buy if the utmost in **COMFORT, ECONOMY, SPEED, LONG LIFE** and **UTILITY** is to be realized.

The performance records of the **EXCELSIOR** Motorcycle stand out as a final proof that of all good motorcycles the **EXCELSIOR** is the **BEST** and, therefore, deserves the first consideration in the mind of the prospective purchaser.

See an *Excelsior Dealer* to-day or write for our catalog

EXCELSIOR MOTOR MFG. & SUPPLY CO. 3709 Cortland St. CHICAGO

Save Laundry Bills

CHALLENGE CLEANABLE COLLARS

Insurance against soot, cracking, and stain or perspiration willing. The appearance, fit and flexibility of your "linen" collar with not starch but water-proof stiffening. Ever white. Dull linen finish.

30c each. Order a half dozen from your dealer or send direct. State your style and half size. Booklet on request.

E. I. Du Pont de Nemours & Co.
The Arlington Works
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Your Opportunity

Dodge High Building Costs

Lewis Machine Cut Houses Solve the Problem

Buy your house direct from the factory at the inside price. Avoid extravagant waste—No planning is done and all work finished in our modern efficient factory without waste of material, time or labor.

Choice of 100 Designs—Houses, Cottages, Bungalows

Select your house from our catalog and we will ship it complete to you with full instructions, accurate plans and specifications—All materials are complete, even hardware, paint, nails, etc., are included.

Our Modern Efficiency Method of Home Building

Saves 40% of carpenter labor—Saves Waste—Saves time and any possible disappointment. We will allow inspection of materials before payment. Send 4c postage for catalog of floor plans, pictures and prices. (Also Home Furnishing Catalog on request.)

Lewis Manufacturing Company
Dept. 1042, SAY CITY, MICH.



When writing to Advertisers please mention Popular Science Monthly



Baldness

is a handicap in business, and in social life

Very often in the hustle of modern life we do not notice that baldness is creeping upon us—but others do.

There are many things which contribute to baldness, yet the real roots of the hair die hard.

You may suffer from dandruff, falling hair, prematurely gray hair, an itching or eczema of the scalp, sticky or matted hair. It is a well known fact that certain germs will cause degeneration of hair health, just as certain germs affect bodily organs.

To attain hair health these germs must be destroyed. We have studied the various causes of baldness and evolved the **Scientifically Correct**

Calvacura METHOD OF HAIR CULTURE

We believe that in the Calvacura Method the hitherto unattainable has been attained. We stake our business reputation on the fact that the Calvacura Method will restore hair health.

We do not ask you to take our word alone for it. We simply ask that you let us prove these facts to your own complete satisfaction. Hair health means setting back many years of appearance of old age. There is nothing like a good head of hair to make a man or woman look young.

THE TRIUMPH OF SCIENCE OVER BALDNESS

Is a remarkable book that we will send you together with a sample of Calvacura No. 1.

UNION LABORATORY, 510 10th St., Binghamton, N. Y., U. S. A.

IF YOU WISH HAIR HEALTH, USE THIS COUPON

LIBERAL SAMPLE COUPON

Name

St. and No. of Box

Town

State

Mail this coupon with the effect of stamps, to show your good faith, to the Union Laboratory 510 10th St., Binghamton, N. Y., you will receive a liberal sample of Calvacura No. 1 and the book, *The Triumph of Science Over Baldness*

OTHER WOMEN AND MEN TELL OF THE SUCCESS OF CALVACURA

MR. JOHN MALCOLM writes: "The sample box started a growth of new hair and I am so pleased I am sending for a full treatment."

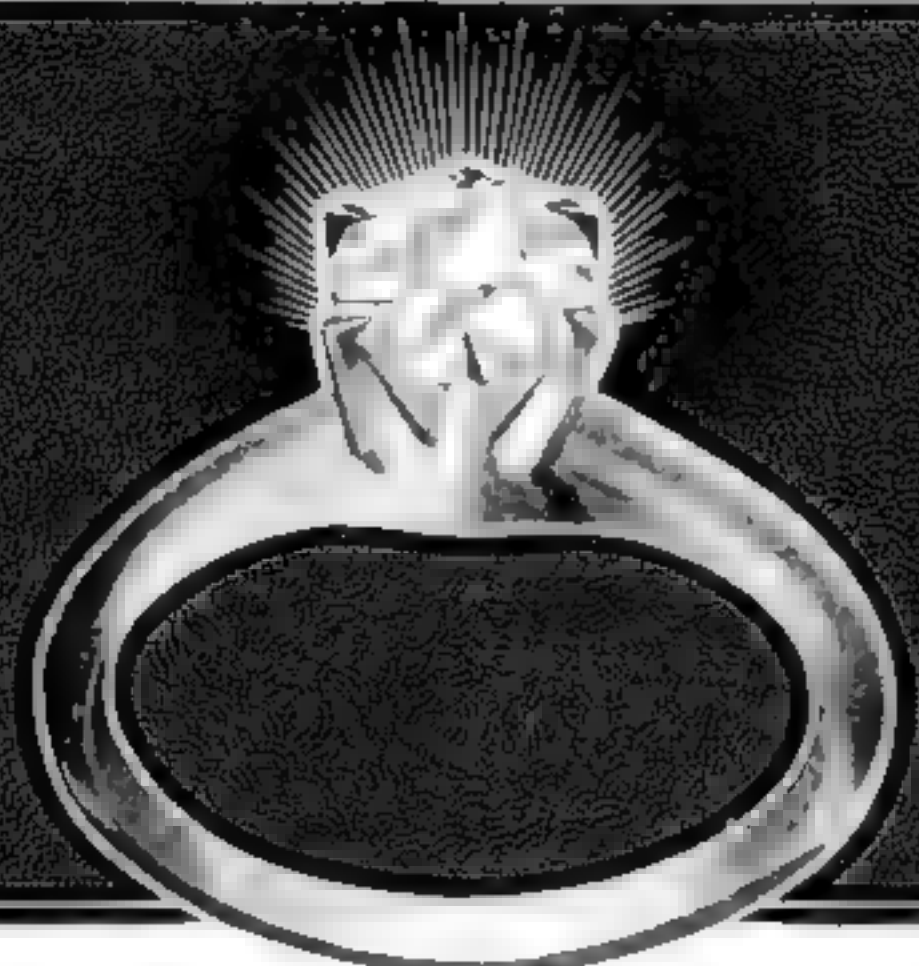
MR. FRANK H. WRIGHT says: "Your Calvacura No. 1 cured me, also my brother-in-law, and I can recommend it to anyone."

MR. H. WEDIN writes: "I have used Calvacura No. 1 and my hair has ceased to fall out and is now in good condition."

MRS. ROSA STEPHENS writes: "I used the sample and I think it is simply fine."

SAMPLE TEST FOR DANDRUFF

Run a comb through your hair. If you find hairs adhere to it, examine them closely. If the root is pale, dry, dead looking, take warning and correct the trouble if you want to save your hair and make it grow.



If You Can Tell a Lachnite from a Diamond—Send it back

YES, we'll send you one of these exquisite man-made gems and you can wear it for 10 full days at our expense. Put it to every diamond test you ever heard about—fire—acid—diamond file. Compare its brilliance with the brilliance of a mined diamond. Notice how it is cut—by world renowned diamond cutters. Test it in every way. Wear it everywhere you go. Then after ten days—if you are able to tell which is your Lachnite and which is your diamond—or if any of your friends have been able to tell the difference—send the Lachnite back to us. The trial does not cost you a penny. If you decide to buy the Lachnite, pay only the rock-bottom price, and if you wish—at a rate of a few cents a day. Our new jewelry book (sent free) tells about our generous terms. Send the coupon for it today. You will be delighted.

Set Only in Solid Gold

Lachnite Gems are mounted only in solid gold. To hold these splendid jewels we have secured the latest and newest ideas in solid gold settings. In our new catalog you will see illustrated rings by the score for both men and women—bracelets, La Vallieres, stick pins, cuff links—all the newest jewelry—made of solid gold. Write for our new catalog today. It's free—and it has a message for you.

Send the Coupon For Our New Catalog!

Put your name and address in coupon or on a postcard and get our new jewelry book. It shows handsome illustrations of newest solid gold mountings from which you have to choose. Too—it tells the interesting story of how Lachnites are made—and why their brilliance is guaranteed to wear forever. Send coupon for it today—it is free—no obligation.

Harold Lachman Co. 12 N. Michigan Ave., Dept. 1207 Chicago



Pay As You Wish

Do not decide to buy a genuine Lachnite Gem until you have worn it for ten full days. Then—if you wish—you may pay for it at the rate of only a few cents a day. Terms as low as 3½ cents a day—no interest. You don't pay for trial. No red tape; your credit is good.

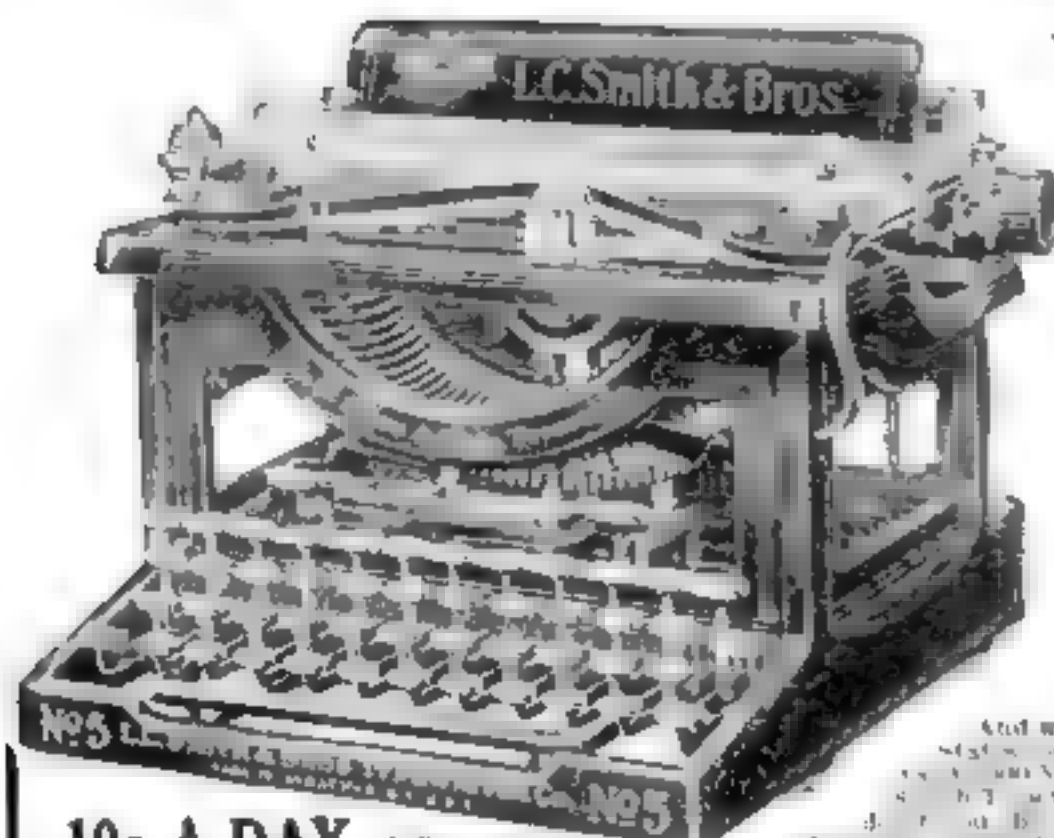
Harold Lachman Co.

12 No. Michigan Avenue, Dept. 1207 Chicago, Ill.

Gentlemen: Please send me, absolutely free and prepaid, your new Jewelry Book and full particulars of your free trial, easy payment plan. I assume no obligations.

Name _____

Address _____



10c A DAY

Pays Us

A dime a day gives you the use of this fully guaranteed Model 5 Smith while you complete payment. It is worth more than that small sum a day to have such a typewriter in which you can place absolute dependence. Anyone needing a typewriter can get it on these terms.

Send the Coupon Now for Catalog and Offer

Larkin Co. Desk TFSM-1017 Buffalo, N. Y.

Send all the details of your offer on the factory-rebated Model 5 L. C. Smith with complete descriptive Typewriter Catalog.

Name _____

Address _____

What Other Typewriter Approaches This Record

Where will you find another typewriter so universally adopted by great business institutions as this one? Space permits mention of only those using from 100 to 2000 Model 5 L. C. Smith Typewriters the same make and model as here pictured. The publishers of The Ladies' Home Journal, and Saturday Evening Post, Arme White Lead & Color Co., Du Pont Powder Co., Firestone & Rubber Co., International Harvester Co., Kellogg Toasted Corn Flake Co., National Biscuit Co., National Surety Co., Park, Davis & Co., Sears Roebuck Co., Sherwin Williams Co., Walway Process, A. L. Crosby Co., Westinghouse Interiors, six Great Railway Systems, Larkin Co. No other typewriter can equal such an honor roll as this.

Model 5

L. C. Smith Typewriters

And we haven't mentioned the biggest user of all, the United States Government. Up to the time war was declared, Uncle Sam used Model 5s. Since then he has bought thousands more L. C. Smith typewriters. If other typewriters were being so largely used, wouldn't their makers would tell you so? There is no merit in advertising a product so important to them and to you. You should know that in purchasing this genuine factory-rebated Model 5 which we offer, that according to the judgment of these great business firms and the United States Government, you can get no better. Their large order puts a stamp of approval on this Typewriter which you cannot afford to ignore.

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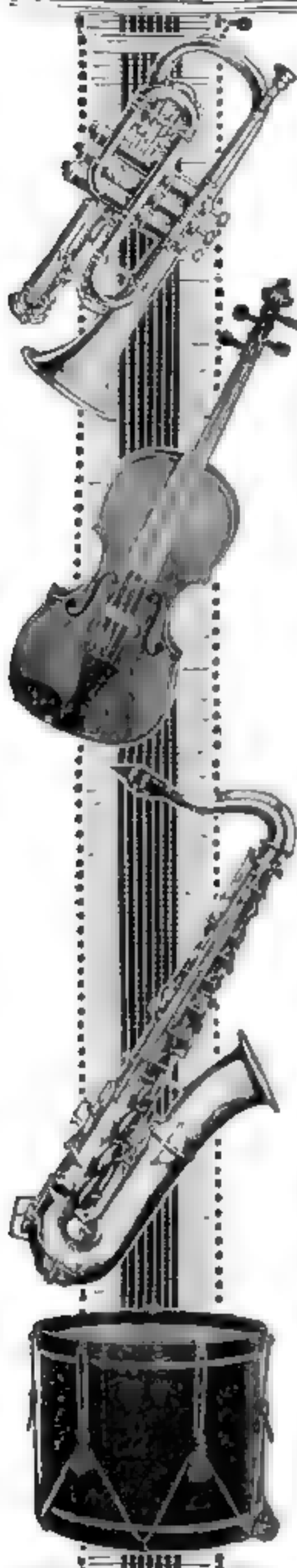
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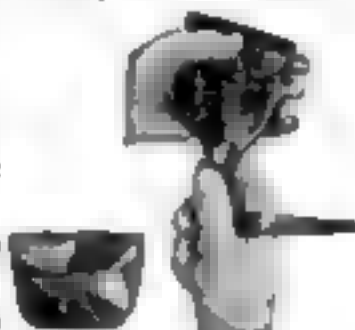
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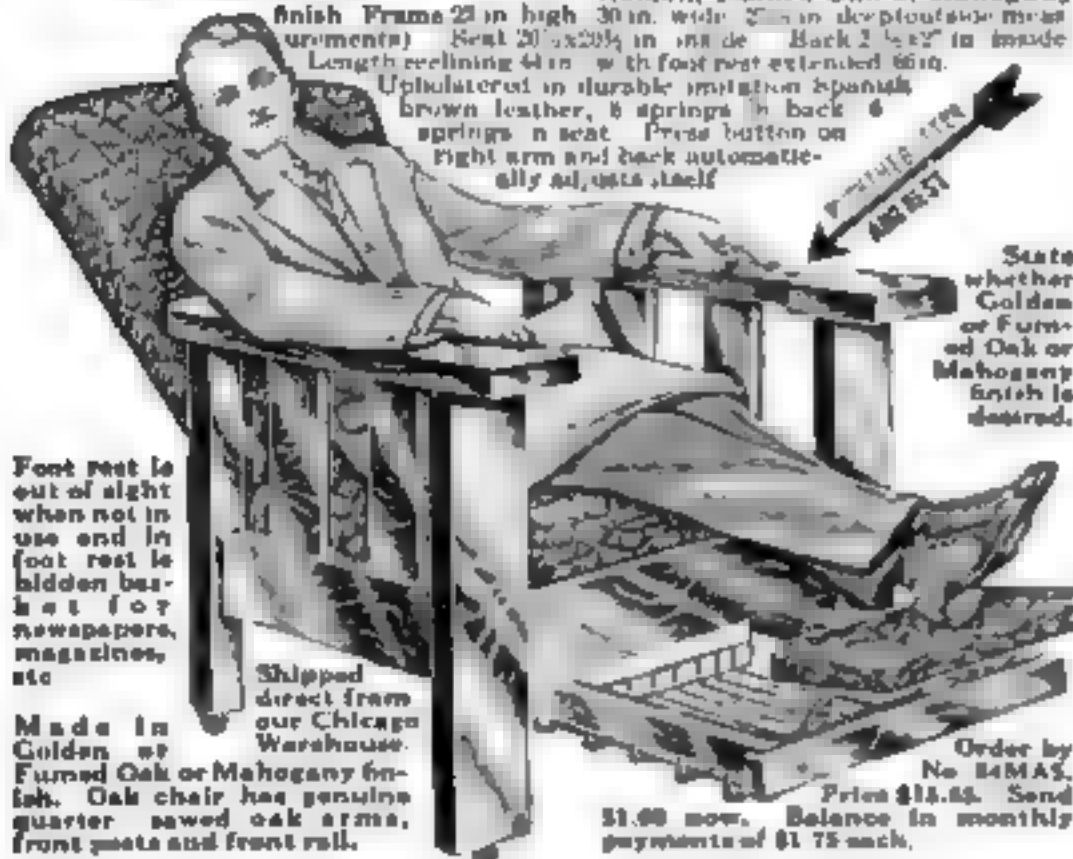
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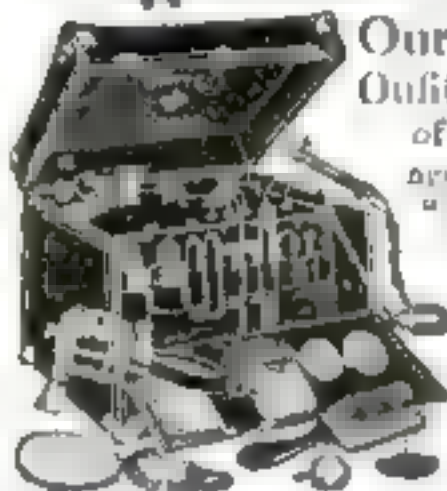
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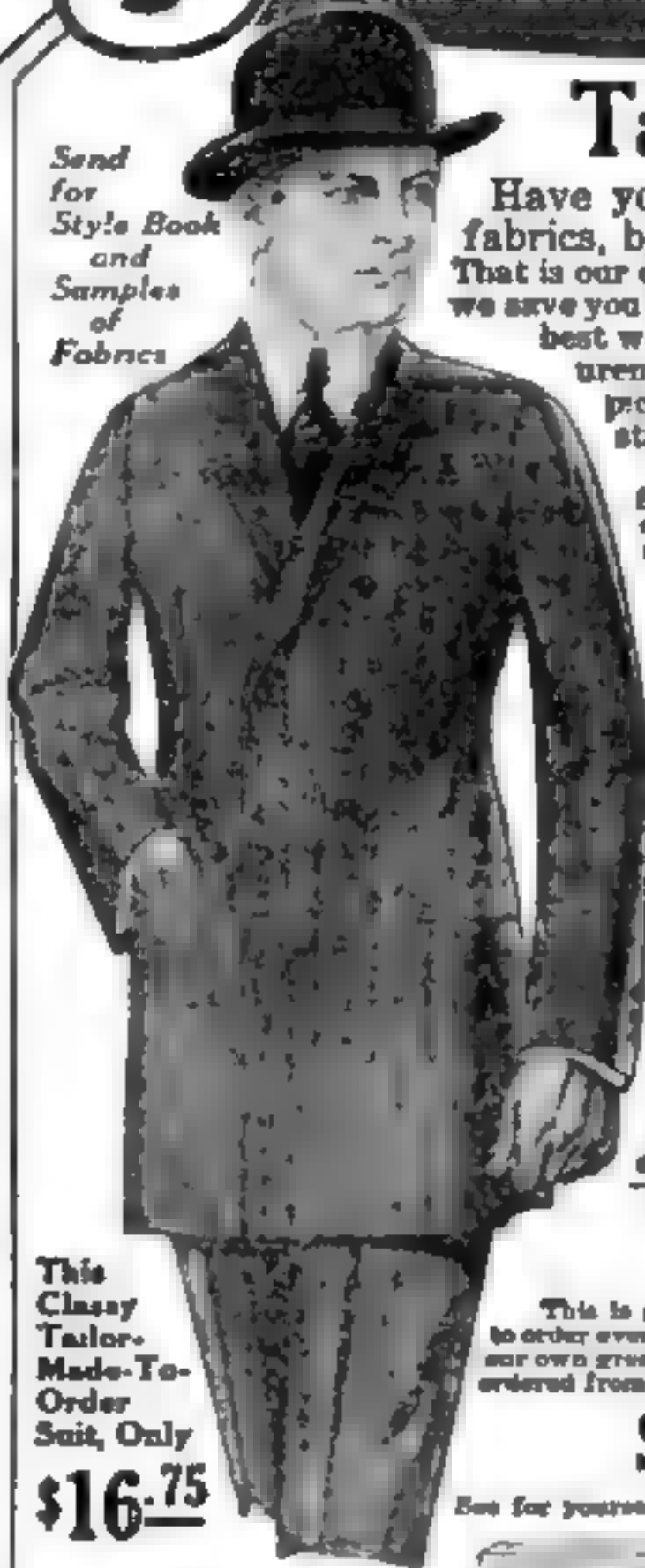
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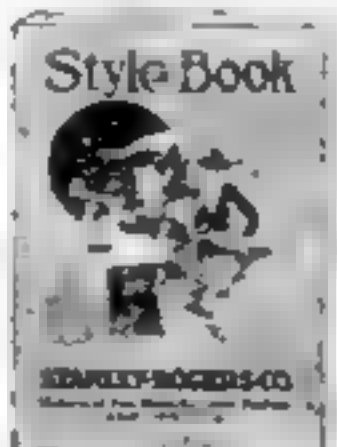
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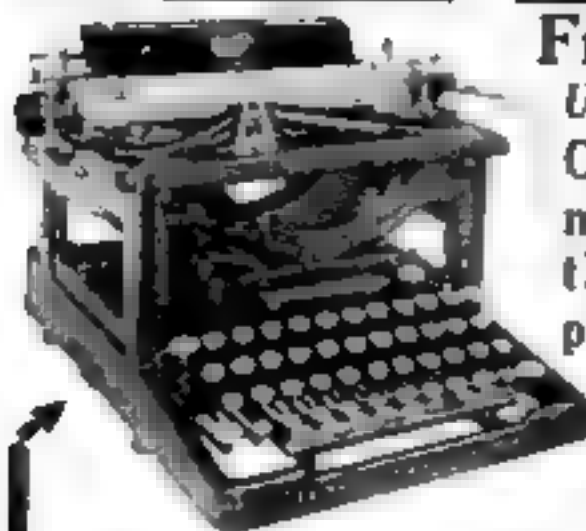
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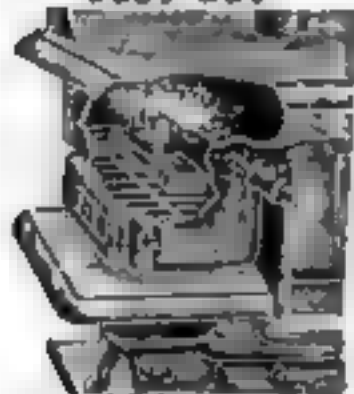
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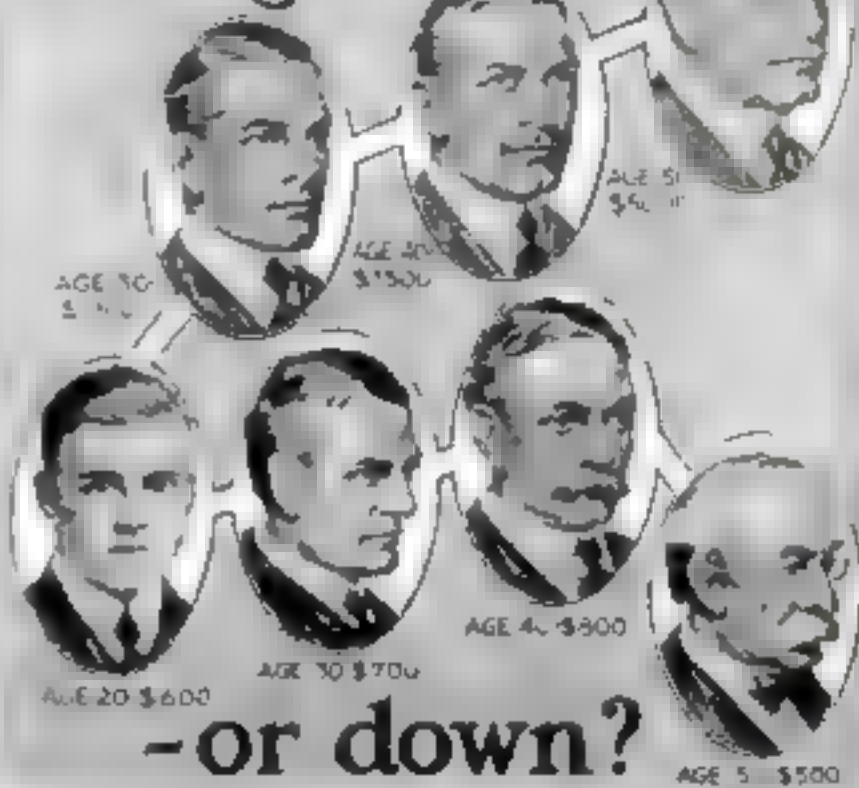
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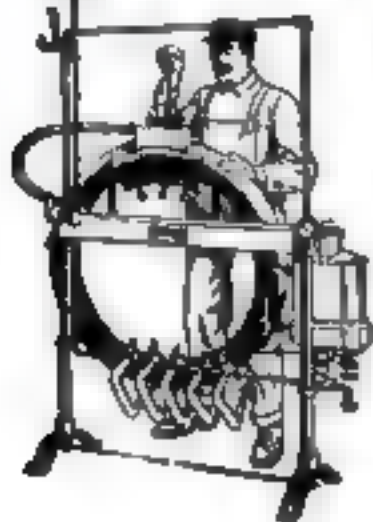
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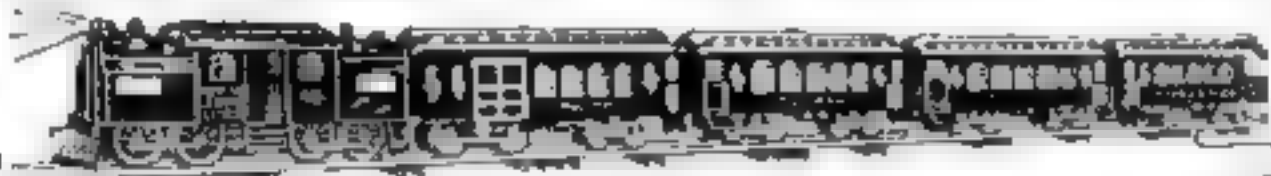
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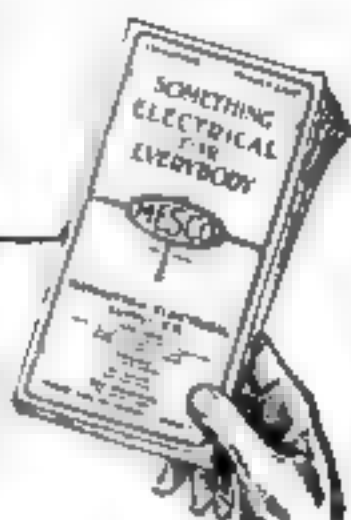
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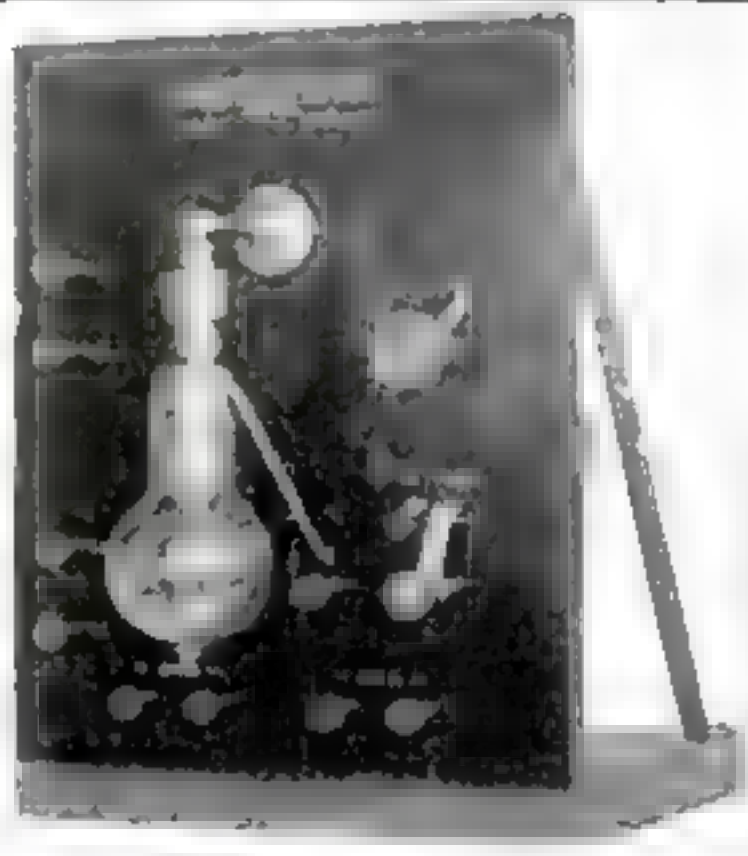
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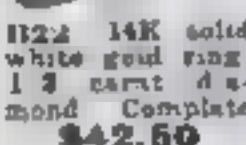
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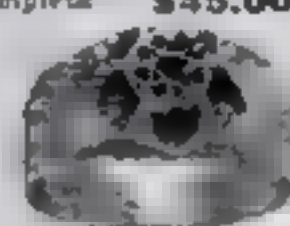
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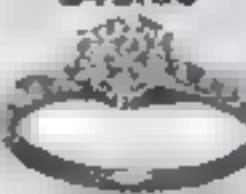
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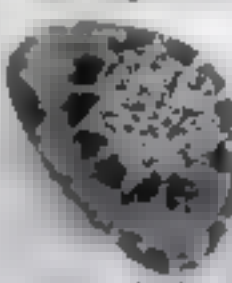
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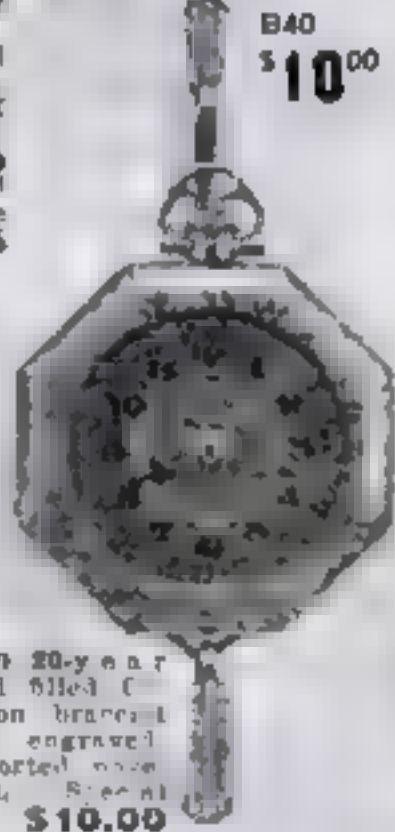
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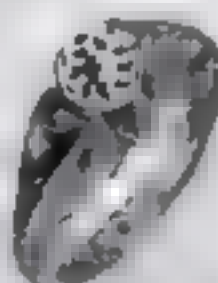
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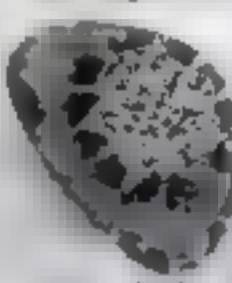
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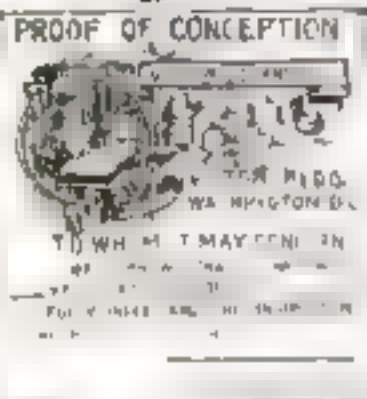
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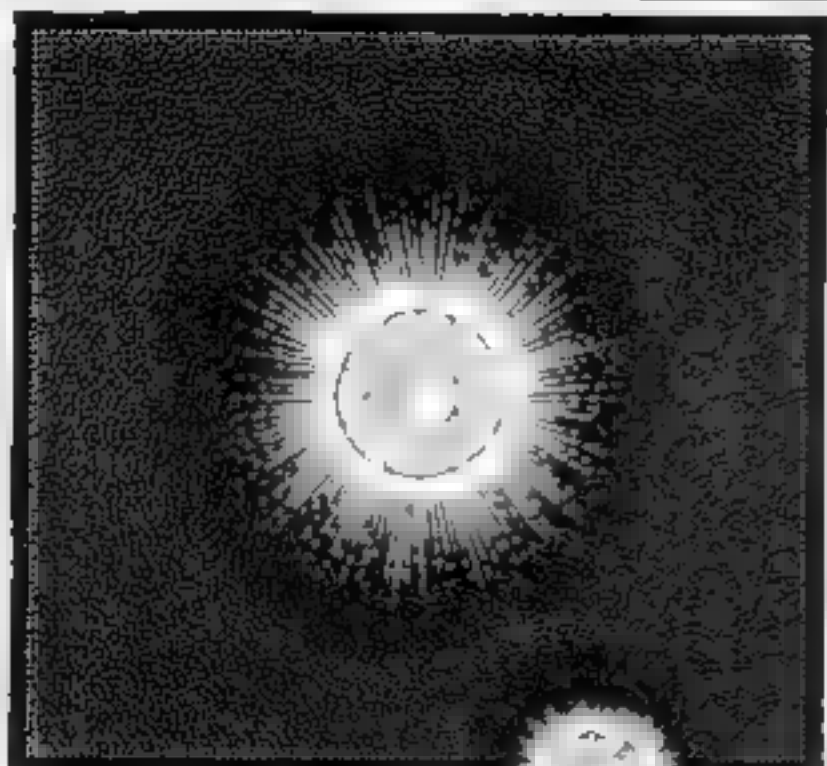
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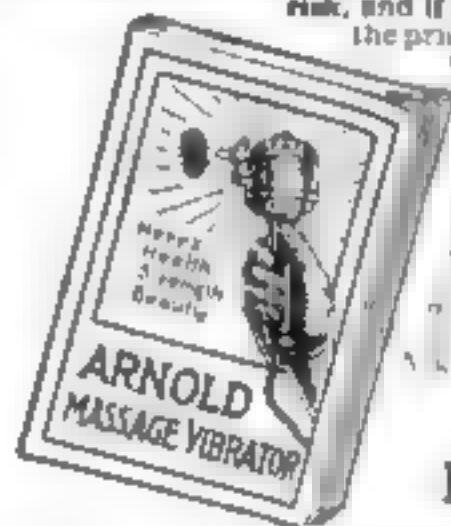
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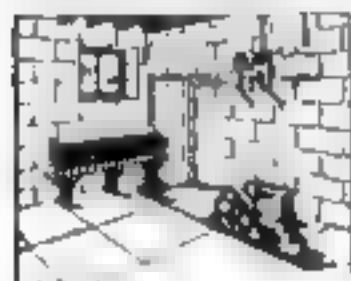
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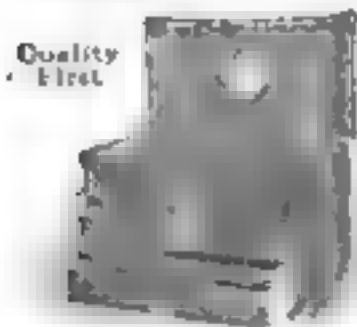
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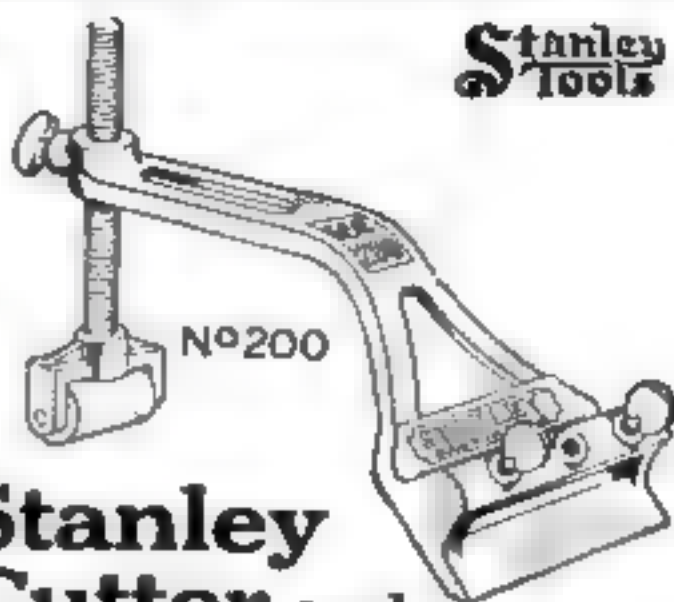
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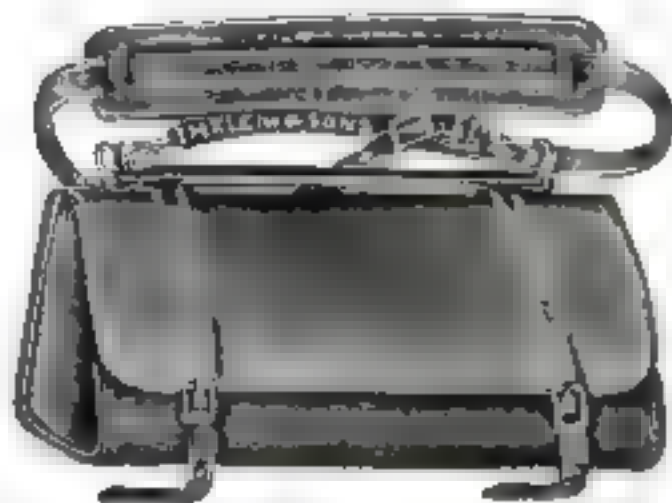
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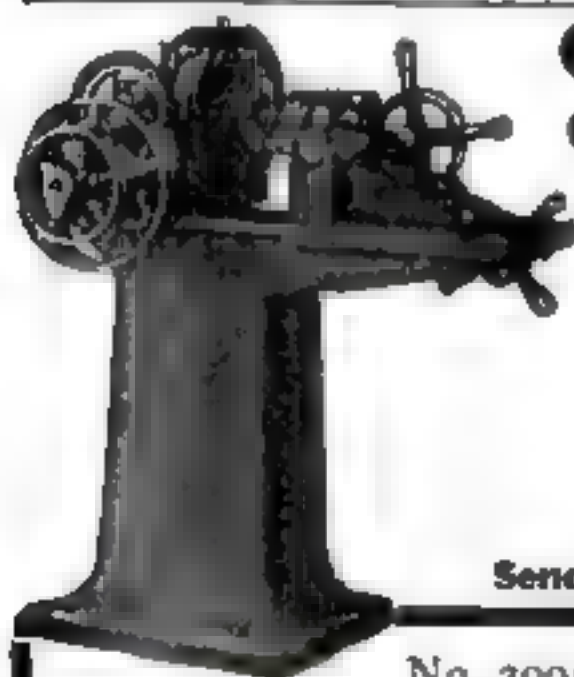


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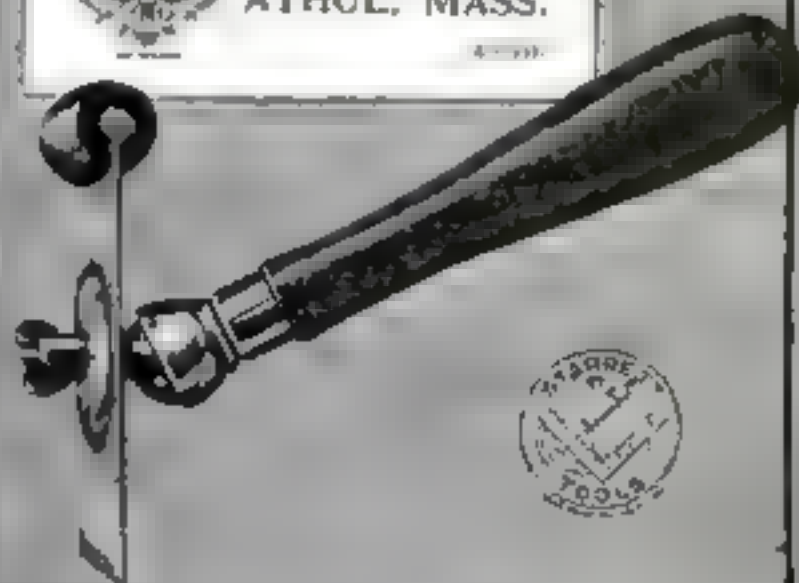
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Every saw is made of steel of the highest quality. Made for service and lasts for many years. Simonds Saws are the best of the world. They are the only saws that are made of the best steel. They are the only saws that are made of the best steel. They are the only saws that are made of the best steel.

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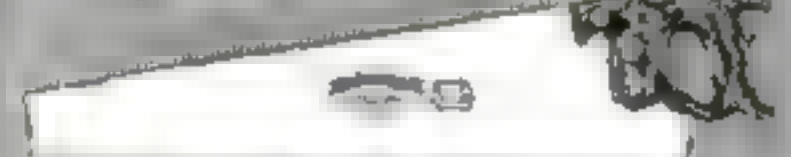

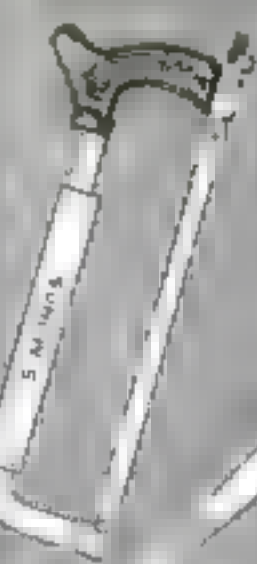


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Convenient for holding irregularly shaped work
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Oxy-Acetylene Welding and Cutting

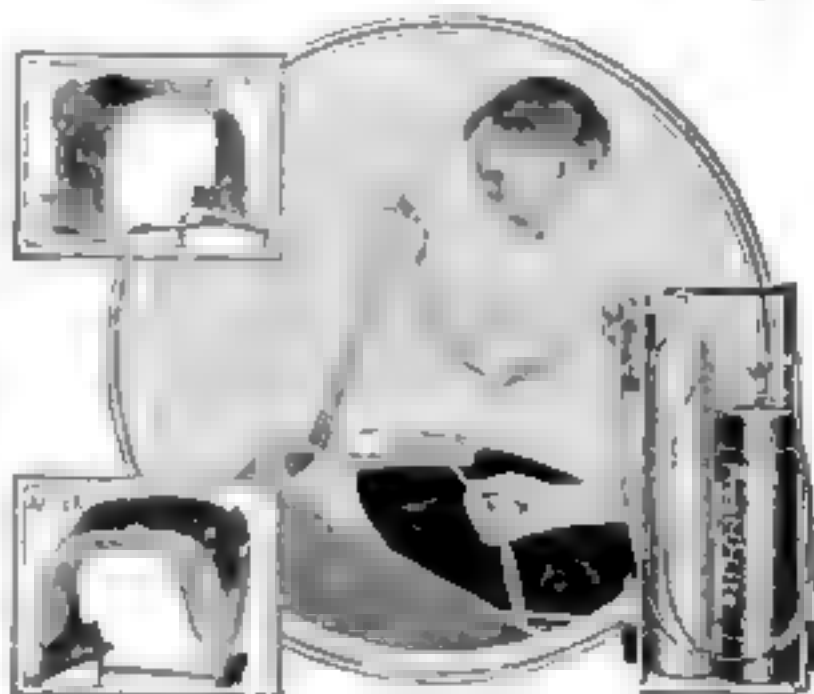
Combating higher material costs by saving waste

IN practically every line of metal manufacture and repair work—oxy-acetylene welding means the conservation of time and material. Its savings are offsetting the increased cost of materials in many great factories.

In thousands of instances, such as the making of aluminum bodies, this process has opened new possibilities in the design and manufacture of higher quality products at lower cost.

In the manufacture of practically every metal product—oxy-acetylene welding makes the finished product stronger and neater—simplifies production—cuts costs—**minimizes material waste.**

From the manufacture of massive machinery to the making of delicate surgical instruments, this process is, in many instances, supplanting the bolt and rivet where two pieces of metal are to be joined.



Aluminum sheets are welded into the steel of this automobile body, enabling the manufacturer to utilize small pieces of valuable material which would otherwise become scrap.

Prest-O-Lite

PROCESS

Provides a simple, inexpensive, portable process of welding for all classes of work. Prest-O-Lite Dissolved Acetylene is furnished in convenient cylinders, making the welding outfit portable for use inside or outside the shop.

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In thousands of shops and factories, in almost every line of industry, this process is reclaiming valuable materials and parts from the scrap pile.

By avoiding costly tie-ups and delays in production through the breakdown of an important machine, and also by saving the cost of a new part, one Prest-O-Lite welding repair can easily save the entire cost of the outfit.

Our literature describes hundreds of profitable uses for the Prest-O-Lite Process in manufacturing, construction and repair work. Write for it.

Big Profits in Job Welding

Repair shops and garages are making good profits for themselves and saving time and money for customers by doing job welding. Your customers will appreciate this service.

To enterprising mechanics job welding presents a first class business opportunity. Equipment cost is low. Immense and growing demand insures steady profits from the start. Write us for details TODAY.

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You can count on a Disston, whether it be the smallest box-making or type-metal cutting saw, the sixty-five foot band-saw of the Pacific Redwood country or the big metal-cutting saws of the Pittsburgh steel plants.

DISSTON

SAWS AND TOOLS

If you make things of wood or metal or stone, you probably can use a Disston power saw to advantage. Write us, telling us the kind of work you do and we will tell you frankly whether a power saw will save you time and money or not, and what kind is best suited to your needs.

Disston circular and band-saws. Disston hand-saws, Disston trowels, files, screw drivers, levels, squares, gauges and all other Disston tools are of the same Disston quality.

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Toronto, Canada



For the Home Carpenter

To make close joints in moldings, railings, and such ornamental woodwork, an accurate Mitre Box is an absolute necessity. The Goodell-Pratt All-Steel Mitre Box is fully up to the standard of the tools on which the maker's reputation for high quality is based. Made entirely of steel, framed like a bridge truss, it is unbreakable and remains absolutely accurate after years of daily use.

This box is furnished with Disston Saws in five sizes. All sizes have a capacity of $10\frac{1}{2}$ inches at right angles and $7\frac{1}{4}$ inches at mitre. The saw can be set and locked at any angle as indicated on the graduated arc.

For further details send for complete catalog



GOODSELL

1500

This One



J7CK-3CE-1YHT

And the Amateur Mechanic

It's easy enough to cut glass with a good cutter like this Goodell-Pratt turret head cutter. Just run the cutter alongside a ruler lightly—not bearing on too hard—and the sharp little wheel makes a clean scratch across the glass. Glass is so brittle it readily breaks at the scratch. The six cutter wheels in the turret head insure a sharp cutter for a lifetime at an outlay of 30c.

A TOOL to carry in your pocket, in the house, in the car, in the motor boat, on camping or fishing trips—that's what this pocket screw driver is. It really will go in the pocket—it's only $3\frac{1}{4}$ inches long when closed—but it's strong enough for every ordinary use, and has three different-sized blades, all for 65c. Try it and see.

The machinists' handy set consists of fifteen tool-steel chisel and punches in a convenient case. For metal working, ornamental or practical (as on an automobile), these tools are invaluable, and they cost only \$2.00.

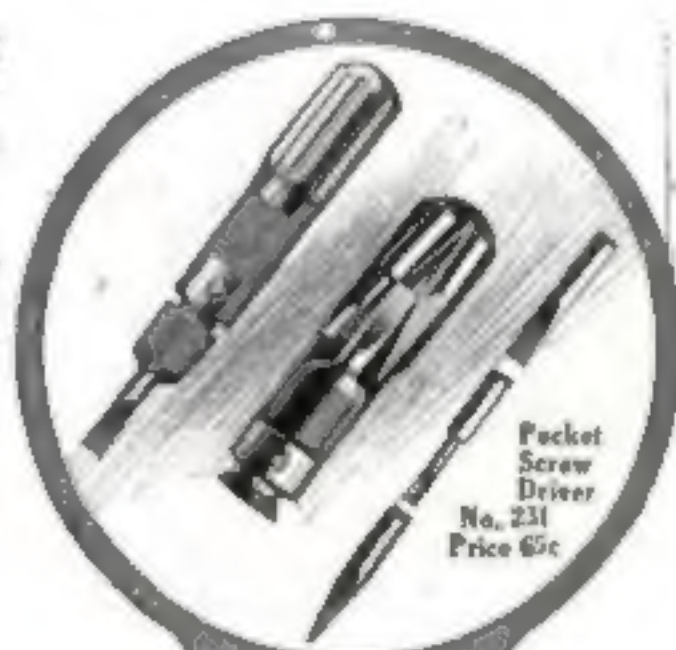
Goodell-Pratt Company *Toolsmiths*
Greenfield, Mass.

Partial List of Goodell-Pratt Tools

Hacksaws	Drills
Gauges	Levels
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Screw Drivers	



Turret
Head
Glass
Cutter
No. 1
Price 30c



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Screw
Driver
No. 231
Price 65c



Machinists' Handy Set
No. 975
Price \$2.00

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GOOD TOOLS



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No smoke—no jars—no cinders—just smooth, even, almost silent travel through the glories of the mountains.

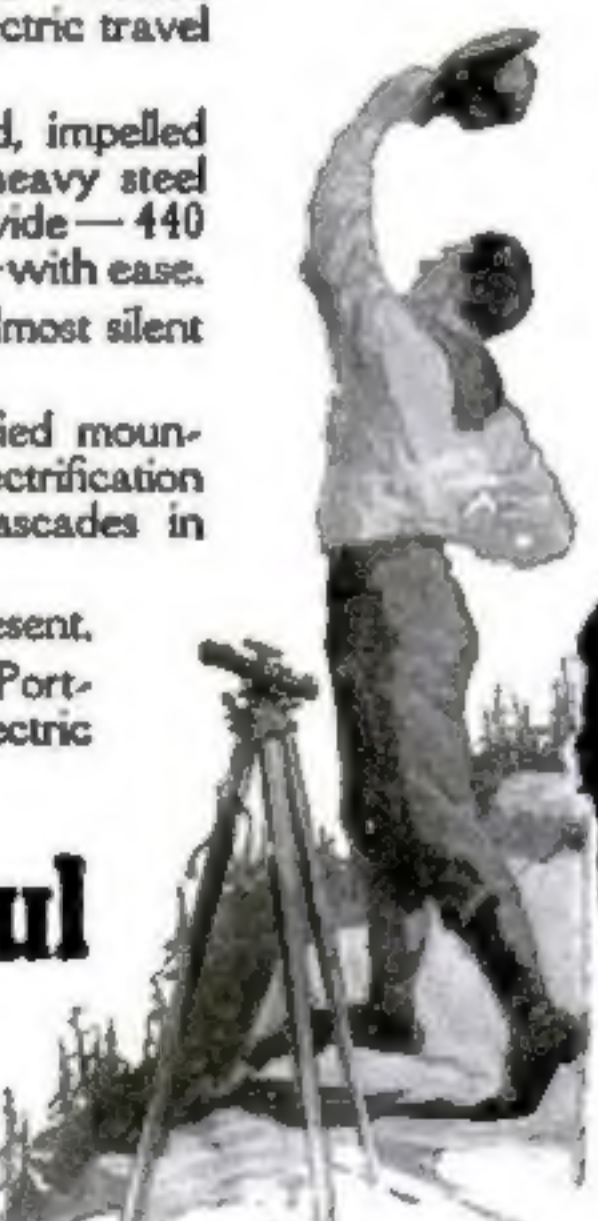
So successful has been the operation of these electrified mountain divisions that work is well under way for the electrification of 211 additional miles through the snow-capped Cascades in Washington.

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